FLIGHT and AIRCRAFT ENGINEER

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The Outlook

Jets and Records

AFTER a series of acute disappointments the U.S. Army Air Forces have put forward an official claim that a P-80 Shooting Star has captured the world's air speed record. This specially prepared Lockheed jet fighter, flying over the 3-km course at Muroc Dry Lake, California, is reported to have averaged 623.8 m.p.h., bettering by nearly 8 m.p.h. the performance put up by G/C. Donaldson last September in a Gloster Meteor IV, and raising the record above the internationally significant figure of 1,000 k.p.h. Official homologation of the claim may take some weeks, but there is no need to withhold our congratulations, first to the Lockheed company for having persevered with the development of a good aircraft, well known to have had its full share of development troubles, and secondly to the pilot, Colonel Boyd. Despite the modest disclaimers of Donaldson and his team, there is no doubt that even under the most perfect conditions, as may have been encountered at Muroc, flight at speeds above 600 m.p.h. is at present a severe trial of skill and physical fitness. If, as there is little reason to doubt, our American friends have set us a new mark, we shall not flinch from putting to the test an improved version of the Meteor, or possibly a prototype fighter as yet on the secret list. Tests with the third DH108 may also justify a new attempt by this special research aircraft. With a Ghost or Nene turbine jet it should be capable of raising the record well beyond the capabilities of any fighter yet flown.

The last series of attempts on the South Coast emphasized how gravely we are handicapped in this country by weather, and we must accept the American's sporting invitation to use their great Californian base or, better still, make our bid in North Africa or somewhere in the Empire. High temperatures, of course, are conducive to the attainment of ultimate speed for a given Mach number. At speeds now attainable each mile-an-hour gain must be won through the most intense aerodynamic and mechanical development, and with the Republic P-84 Thunderjet, and possibly other American fighters, shaping so well, we must avail ourselves of every benefit if our next attempts are to raise the record by a worthwhile margin.

No. 1 Priority—Safety

RECENT research and the further development of wartime radar aids has resulted in the production of equipment which enables the crew of an aircraft to ascertain its position in the air with an accuracy of a few hundred yards almost anywhere over the earth's surface. In addition, instruments have been devised which will automatically control an aircraft in the air and fly it along a predetermined path with very great accuracy. Radar instruments, like those used to fix position, have been designed to give warning of proximity to high ground or dangerous cloud formations. It is significant also that much of this equipment has passed the experimental stages and is in production. In spite of this, it often appears that the movements of aircraft are not so well regulated to-day as they were four or five years ago when airborne radar was just beginning to make its value felt in operations against the enemy. Positions of a thousand aircraft were plotted from minute to minute and high ground, balloon barrages and similar hazards were then equipped with day and night warning devices.

Why do modern transports still on occasions get miles off course? How is it possible that they can fly into mountains, which have stood unmoved for countless centuries in positions clearly indicated on all maps? It is probable that looking beyond I.C.A.O.'s equipment selection and standardization problems once more the answer may be essentially the one advanced to account for so many shortcomings today—lack of manpower and money.

At present a primary need seems to be aids to approach and landing in bad weather, take-off never having been so difficult a problem. In this issue of *Flight* is described one example of newly developed equipment which makes fully automatic approaches to land a commercial possibility. Recently it has seemed that of even greater importance is the need for control and accurate guidance over obstructions in normal flight. Whatever the possible causes, steps must be taken at once to make it virtually impossible for an airliner to fly into a mountain or other obstruction. The very serious effect of repeated collision accidents on the general public and upon their attitude towards flying must not be underestimated. Is it necessary to order that if its track after take-off lies over a mountain range, an aircraft must invariably climb away on another safe heading until adequate safety height is reached, and must pilots be briefed to overfly an airport and let down on the far side if a direct descent may mean cutting it a bit fine on the approach over some obstruction? Economy of operation cannot be allowed to influence safety considerations in these matters. If it results in an appreciable reduction in accident risk, radar warning devices which are now available should also be fitted, even if they are costly to buy and maintain and cause a slight reduction in payload.

It may well be that if the world's operators do not, for financial or other reasons, take action of the sort suggested, insurance policies for non-equipped, non-complying companies may be affected to such an extent as to make them think again.

Many of the important advances in safety of marine navigation were the outcome of action by Lloyds, and some people believe that the aviation insurance interests of this historic, world-influencing association are following a course similar and equally important to that taken by those of shipping nearly two centuries ago. Lighthouses, buoys and lightships are now taken for granted, and one wonders perhaps if Lloyds should not again accept the responsibility for introducing measures or giving at least the lead towards increasing the safety of another form of transport and travel for all nations.

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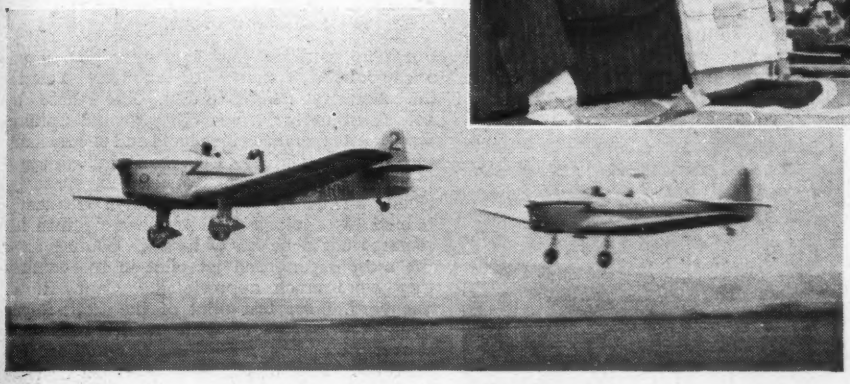
PROBING AND PROVING

"Flight" photographs.

Before going to the Derby Air Rally, the Minister for Civil Aviation toured the Rolls-Royce works at Nightingale Road and at Sinfin. (Top left): Lord Nathan takes a Derwent V up to 14,700 r.p.m. (Top right): Examining a test record with Mr. E. W. Hives on his right, and Sir Ben Lockspeiser. (Lower left): Alongside a Derwent on a high-power run. (Lower right): Mr. A. G. Elliott, Dr. S. G. Hooker and Sir Ben Lockspeiser, with the aid of a sectioned Derwent V, give Lord Nathan some instruction on the whys and wherefores of jet propulsion.

DERBY'S DAY

Polished Flying by Contrasting Types : Continental Visitors Converge on Burnaston



Flt./Lt. J. Findlay, staff instructor of Air Schools Ltd., Derby, receives the Harben Memorial Trophy from Mrs. Harben. Lord Nathan approves. Findlay's narrow victory is seen on the left.

Illustrated by "Flight" photographs

GUESTS flying from the Continent for last Saturday's International Air Rally at the Derby Airport, Burnaston, encountered some dirty weather ; but their troubles were light compared with those of the citizens of Derby. Frustrated by an unofficial bus strike, these indefatigable enthusiasts made their several ways to the airport, one eye apprehensively cocked at the threatening sky, the other hopefully scanning the stream of cars along the Derby-Burton road.

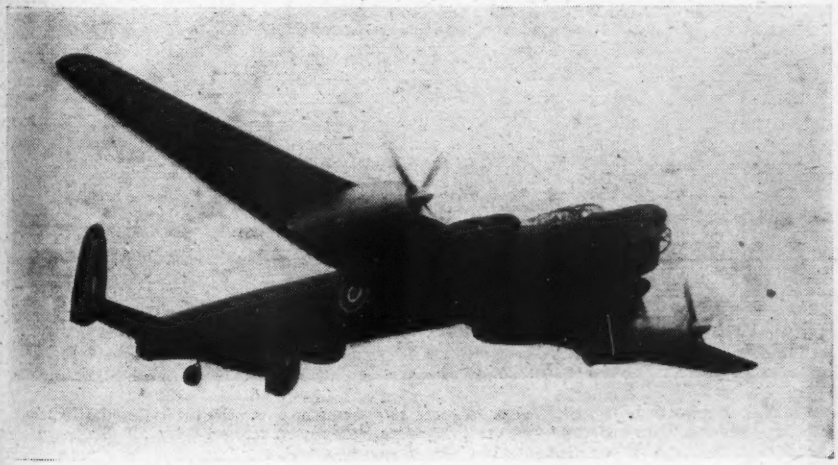
Their determination was well rewarded, though many arrived too late to see a smart body of Derby A.T.C. cadets pay military honours to Lord Nathan. The Minister was accompanied by the Mayor of Derby and was joined by the Secretary for Air, who arrived in fitting style by Avro XIX.

Miraculously the weather held, and the afternoon's programme ran smoothly, as it could hardly fail to do after thorough planning by the Derby Aero Club in conjunction with the Derby Corporation. The organizers paid tribute to the late W/C. Roy Harben, D.F.C., who originated the idea of the rally and undertook the preliminary work. The co-operation and support of Rolls-Royce, Ltd., and the assistance of the Wolverhampton Aero Club, were readily acknowledged.

The Guests Get Through

Of the 113 visiting machines, twenty-four from Denmark, Belgium and Switzerland did not log in until Saturday morning, having been weatherbound at Lympne. Their occupants missed a truly Rolls-Royce cocktail party. A Skyways Lancastrian, piloted by Capt. R. J. Ashley and bearing General Critchley, was another Saturday arrival. This was the first aircraft of its calibre to put down at Burnaston and very imposing it looked among the Austers, KZ-3, Pragas and the like which inundated the perimeter and overflowed into the fields.

Lady Nathan and the Lady Mayoress having received bouquets from passengers in a Standard 8, which was itself disembarked from an Aerovan, and Lord Nathan having formally opened the proceedings, five Magisters got away for the race for the Harben Memorial Trophy, presented by the Harben family for annual competition by pilots in the employ of Air Schools, Ltd., and associated companies. For handicapping purposes the performance of each aircraft—even its acceleration on take-off—had



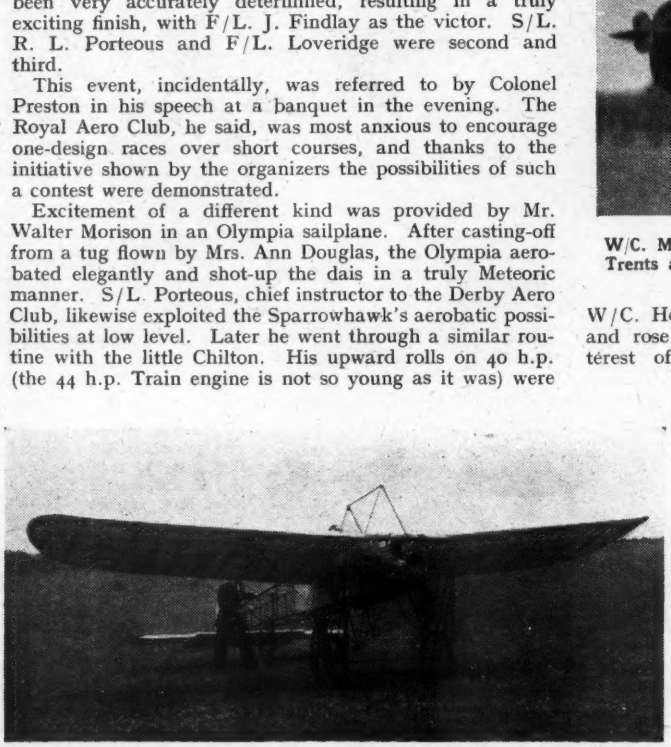
For demonstration purposes the unpainted nacelles of the Bristol Theseus airscrew turbines on the Theseus Lincoln are a distinct advantage. Mr. Pegg flew this important development type from Bristol.

DERBY'S DAY

been very accurately determined, resulting in a truly exciting finish, with F/L. J. Findlay as the victor. S/L. R. L. Porteous and F/L. Loveridge were second and third.

This event, incidentally, was referred to by Colonel Preston in his speech at a banquet in the evening. The Royal Aero Club, he said, was most anxious to encourage one-design races over short courses, and thanks to the initiative shown by the organizers the possibilities of such a contest were demonstrated.

Excitement of a different kind was provided by Mr. Walter Morison in an Olympia sailplane. After casting-off from a tug flown by Mrs. Ann Douglas, the Olympia aerobated elegantly and shot-up the dais in a truly Meteoric manner. S/L. Porteous, chief instructor to the Derby Aero Club, likewise exploited the Sparrowhawk's aerobatic possibilities at low level. Later he went through a similar routine with the little Chilton. His upward rolls on 40 h.p. (the 44 h.p. Train engine is not so young as it was) were



Under the power of its Anzani engine, with 2-volt trembler coil ignition, the 1909 Bleriot monoplane taxies by.

a revelation. Low as this power may seem today, the 1909 Bleriot, which was prevented from becoming airborne (under pilot control that is) by a stiffish wind, had only 22 h.p. in its fan-type Anzani.

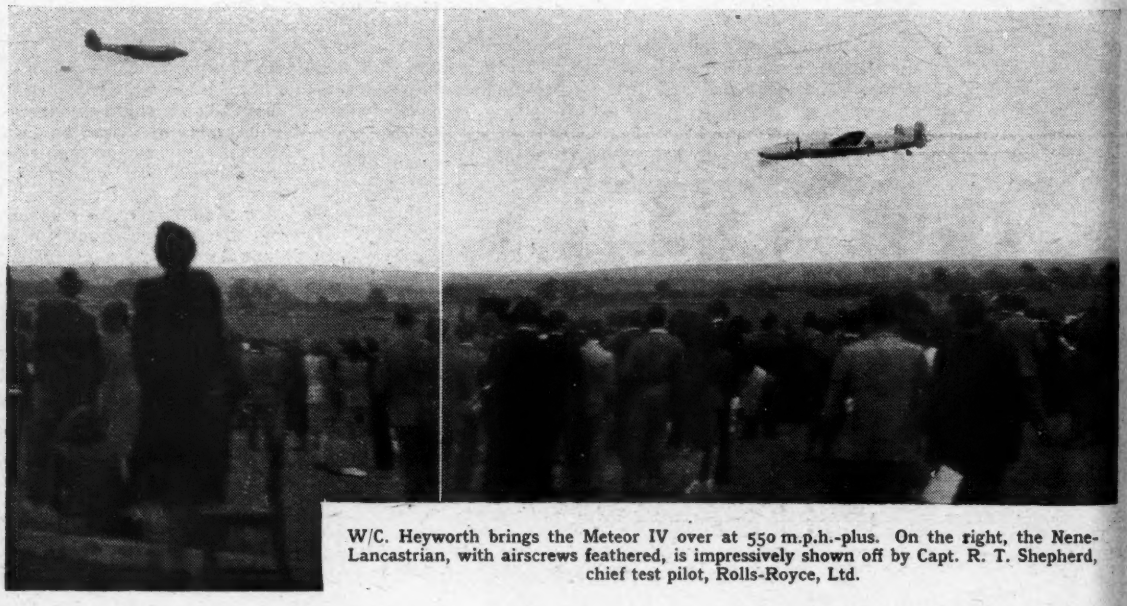
Under the urge of its 20,000 or so equivalent h.p., a Meteor,

W/C. McDowall, after a feint touch-down, opens up the Trents and starts a steep climb-away to demonstrate the acceleration of the units.

W/C. Heyworth up, passed by at a genuine 580 m.p.h. and rose to 12,000ft in a matter of seconds. The interest of the Meteor's demonstration, like those by the Trent-Meteor, Nene-Vampire and Spitfire, was greatly enhanced by a lucid and clearly audible R/T commentary. Like the other high-speed types, the Meteor was restricted in space by cloud, for which W/C. Heyworth frequently offered his apologies. Even in a 6g turn his remarks could be easily heard. Coming from the most experienced jet pilot in the country they were much appreciated. Capt. R. T. Shepherd, chief test pilot of the Rolls-Royce Company, made several impressive runs—one at over 300 knots—in the Nene-Lancastrian. On the first of these the Merlins appeared to overfeather, momentarily going into reverse.

A less familiar Rolls-Royce flying test bed was the Meteor with Trent airscrew turbines, flown by W/C. McDowall. The first airscrew turbine type to fly, this has a really surprising performance, particularly in acceleration. Ample proof of this was offered when, after approaching to hold-off height as if to land, the pilot opened up the Trents, retracted his wheels, and immediately went into a very steep climb.

The Nene-Vampire (Mark II), making its first public appearance, was in charge of S/L. M. Graves, who has done much of the test flying on this fast-climbing and high-flying development. His commentary included refer-



W/C. Heyworth brings the Meteor IV over at 550 m.p.h.-plus. On the right, the Nene-Lancastrian, with airscrews feathered, is impressively shown off by Capt. R. T. Shepherd, chief test pilot, Rolls-Royce, Ltd.

DERBY'S DAY

ences to 525 m.p.h. and 5g, which could readily be believed.

The R.A.F. event—aerobatics by a very pretty contra-prop silver Spitfire 21 bearing the markings of 41 Squadron and flown by S/L. F. A. O. Gaze—was weak only in scale. The "Spit" has never been better displayed. Especially attractive were the four-point hesitation rolls.

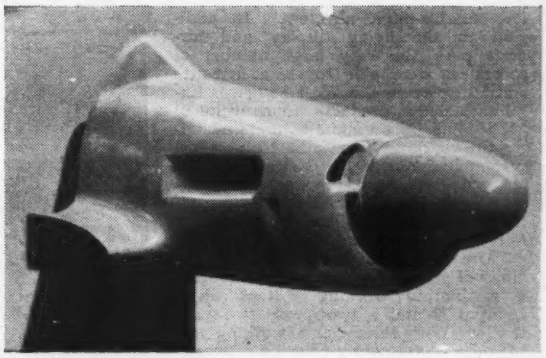
From Bristol came the Theseus Lincoln flown by Mr. Pegg, and a Wayfarer. Both showed off their peculiar merits to the best advantage.

Among the light types the delightful and highly manœuvrable Canadian-built Chipmunk (Mr. Pat Fillingham) evoked special comment. The Globe Swift and Desford Trainer were also comparatively unfamiliar types, and their merits were made manifest. The Gemini and Messenger went through their usual amazing performances of slow flying and short landings.

Mr. R. B. Lynch, of the Martin Baker Aircraft Co., Ltd., did one of his heart-stopping delayed drops, causing the crowd to break through the barriers to greet him.

In the final fly-past visitors were able to see the Praga Baby KZ-VII, a Belgian Fairchild, a Messerschmitt-inspired Noralfa, and a French Air Force Goeland.

One treat which was of necessity denied to the public was an inspection during the morning of the main Rolls-Royce factory at Nightingale Road and the newer test section at Sinfin Moor, close by. The Minister of Civil Aviation was determined to miss nothing and after asking for a description of the working principle of Rolls-Royce Derwent and Nene gas turbines from both Sir Ben Lockspieser and Dr. Hooker (who with Mr. Hives, managing director of Rolls-Royce, accompanied him on his tour) took the throttles of actual power units on test and entered the test cells to see, and more particularly hear, them running. Of particular interest to the party was an Eagle on test and a Dart, ready for running with



Among the Rolls-Royce static exhibits was this one-eighth scale model of the Westland Wyvern nose. The engine is, of course, the 3,500 h.p. Rolls-Royce Eagle.

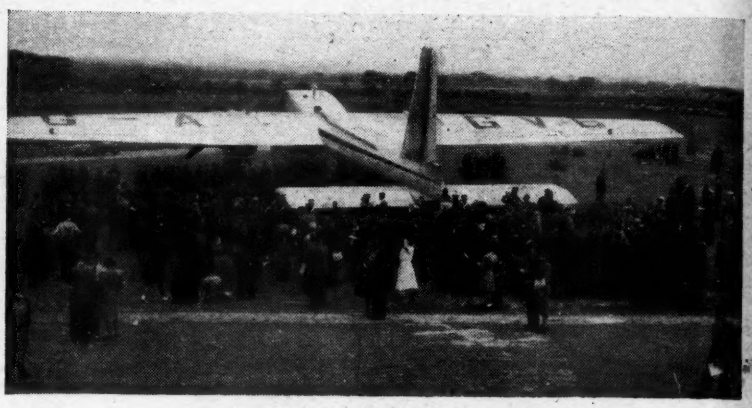
For once spectators and not organizers : Sir Alan Cobham with Lady Cobham (left) and Mrs. Don Bennett. In the background Peter Masefield seeks something to long-term plan.

On the left is an assortment of Continental and British types in one of the aircraft parks. The Reid and Sigrist Desford is taxying in after being demonstrated before the visitors. Upper right is a glimpse of a batch of KZ-3s. The smart communications aircraft in the third view is a Goeland.

its variable-pitch airscrew. In addition to the flying display and aircraft park the very large number of spectators were able to see a first-rate static display in the West hangar. Exhibits included products from several of the leading Derby manufacturers including Crown Derby porcelain. Hobson fuel system components for gas turbines and piston engines, Dockers paints and Goodyear tyres were also available for inspection. The Air Ministry and Venning Aviation had excellent stands.

There were several Rolls-Royce exhibits of great technical interest, notably a fascinating working section of a Derwent V and a two-speed, two-stage Merlin. With these was a working section of a Rotol contra-rotating airscrew. Models formed a part of the Rolls-Royce display and a one-eighth scale Eagle power unit with nose cowling, as fitted to the Westland Wyvern Naval strike fighter, gave first information regarding the appearance of this interesting new machine. The exhaust ports are deeply recessed and the radiator is below the reduction gear, the cooling air intake being below the spinner and the outlet immediately behind the radiator.

Another model showed the suggested layout for a pair of airscrew turbines geared to coaxial airscrews and built into a single wing nacelle, also housing one undercarriage assembly.



The Bristol Wayfarer swallows up spectators by the score.

The purpose of this advanced layout is to reduce interference and drag due to airscrew slipstream, and the particular units in mind, capable of working separately or as a pair, were to provide 3,000 h.p. each (6,000 h.p. for the pair) to power, with a similar pair, an aircraft of about 150,000 lb a.u.w. with a span of 150 ft.

National Gliding Contests

A Good Start to the Week at Bramcote

ON the second day, Sunday, 22nd, of the week's gliding contests organized by the B.G.A. at R.N.A.S., Bramcote, near Nuneaton, the 26 entrants and a number of visitors from this country and abroad were very busy making the most of the good weather—good in the everyday sense, though lacking in lift and therefore not so good for cross-country flying. The whole air of friendly activity, the graceful and colourful array of gliders, and the readiness of everyone to lend a hand to the other man, gave the most pleasant impression. One felt that these pilots and supporters were all of one spirit and an atmosphere prevails which can best be likened to that of a school sports day, or perhaps a scout camp.

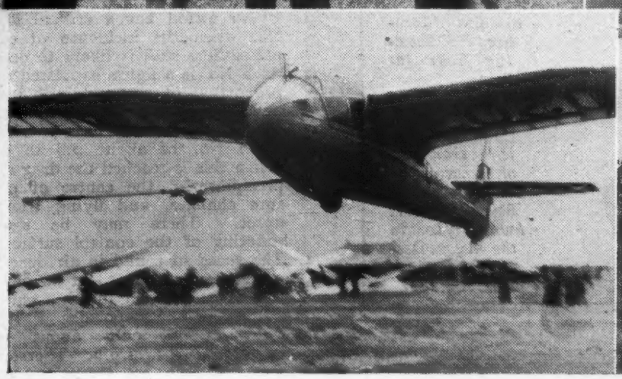
As the name suggests, the contests are only open to British entrants, although foreign visitors are welcomed to study the contest and to fly to and from Bramcote.

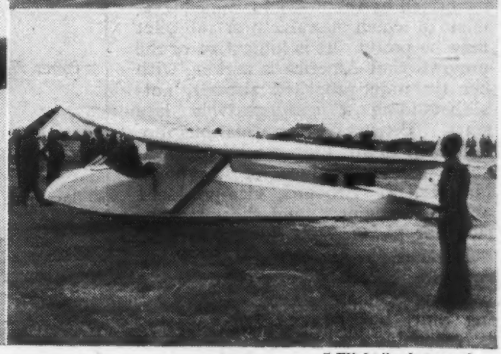
Broadly speaking, the aim of each entrant is to build up a big total of points for his aircraft which may be flown by as many as three different pilots. This is done by goal flights. These require a written statement of one's goal to be made before take-off and then, after being towed into the air, flying as near as possible to it (or, if possible, getting there and back). A proportion of the maximum number of points which can be gained is given for progress in the right direction and bonus points are awarded for height attained over 1,500ft above the release point.

Only the best flight of the day scores for each pilot and the average of the three longest flights of the day decides the scale by which marks are to be awarded for the distance flights of that day. For example, if the average distance is less than 50 miles no marks are awarded for the first 20 miles of any flight, but at the rate of three per mile over 20. For a day average of between 50 and 100 miles marks are awarded at the rate of two per mile for flights of over 25 miles. Should the average be over 100 miles it is necessary to fly for more than 30 miles to score, and marking is at the rate of 1½ per mile over that figure. Marks for height gained

"Flight" photograph

At the launching base. A variety of gliders at rest with a blue Olympia from the Bristol Gliding Club in the foreground. One of the pilots, Flt./Lt. W. Jennings, is seen at the nose.





"*Flight*" photographs.

(Top left) At R.N.A.S. Bramcote (H.M.S. *Gamecock*) Lord and Lady Nathan are seen with Captain G. N. Brewer, R.N., commanding officer, and Mr. Philip Wills. (Top right) Mr. Wills brings in his Wiehe, No. 27. (Lower left) One of the largest aircraft present and not a competitor in the contests, the enclosed side-by-side two-seater Gull II just airborne on the wire. Lord Nathan is a passenger. (Lower right) A new Slingsby design, the 21 is intended for A.T.C. training. *Flight's* representative flew in this promising aircraft.

are at the rate of one per 100ft from 1,500 to 3,000ft above the point of release, two per 100ft for 3,000 to 7,500ft above release, and four per 100ft above 7,500ft. Bonus marks are given for landing within 1,000 yards of a declared point (33⅓ per cent of distance marks gained), for declared out and return flights (100 per cent of distance marks), etc.

Despite not-too-favourable conditions, Mr. Philip Wills, British distance and height record holder (209 miles and 15,247ft respectively), completed an excellent goal flight to Dunstable, 56 miles away, in barely three hours, much of which was blind flying, and during which time he rose in cloud to 9,900ft. He was flying No. 27, a dark blue Weihe. No. 11, a light blue Olympia of the Surrey Gliding Club, was flown by Mr. W. Morison to Croughton airfield which is south of Brackley, and a height of 8,000ft was attained. Capt. R. E. Claudi from 84 Group Gliding Club, B.A.F.O., was the only other pilot to score. His mount was No. 12, a cream Weihe.

Two arrivals by air from Yeovil, more than 100 miles away, were Cdr. C. Nicholson and Lt. Cdr. (E.) P. Blake, who flew No. 7, a light blue Kranich II. They were entered by the Royal Naval Air Command Soaring Association.

During the afternoon Lord Nathan, who was returning from his Derby week-end, visited Bramcote and flew in a new Slingsby side-by-side two-seater known as the 21. The machine is designed for A.T.C. training and this second prototype has shown itself to have excellent characteristics. After flying in this glider with Slingsby's test pilot, Mr. J. W. Leach, Lord Nathan, who found the flight enhilarating but all too short, made a further trip in the enclosed two-seater Gull II with S/L. Furlogh, A.T.C. instructor, as his pilot.

An examination of the results of this year's B.G.A. national gliding contests will enable the selection committee to decide who shall represent this country in next year's week of international gliding contests.

CAR ENGINES SIX INCHES IN DIAMETER?

"ARE we likely to have gas-turbine-driven cars?" is a question many motorists are asking, and in *The Autocar* for June 20th G. Geoffrey Smith, Editorial director of *Flight* and *The Autocar*, examines this subject.

Jet propulsion, as such, he dismisses as impracticable for road vehicles. On paper the gas turbine possesses many advantages; power is produced continuously by rotary motion so that there is perfect balance, light weight is achieved—possibly one-third that of a piston engine. Very high operating speeds imply turbines of extremely small dimensions, perhaps only 6 inches in diameter for a car! Turbines are self-cooled by air flow and so eliminate the need for radiators, and their kerosene or diesel oil fuel reduces fire risk.

There are, however, disadvantages and many problems, says *The Autocar* article. Air must be perfectly clean, the consumption of fuel will be high, and the diminutive unit for a car, which might run at over 50,000 r.p.m., creates a real problem in gear box design. Aircraft turbines are built to extremely fine limits and, therefore, are costly to produce.

Perhaps, writes G. Geoffrey Smith, the first practical use of a gas turbine delivering shaft power to a road vehicle might be on long-distance coaches or commercial vehicles: light aircraft and high-speed marine craft may lead the way with the first use of small gas turbines.

—"And then gentlemen, if Captain Oakehampton fails to keep her straight, I think we may assume the gas turbine to be superior."

The World Speed Record

Britain Temporarily Robbed by American Shooting Star

By G. GEOFFREY SMITH, M.B.E.

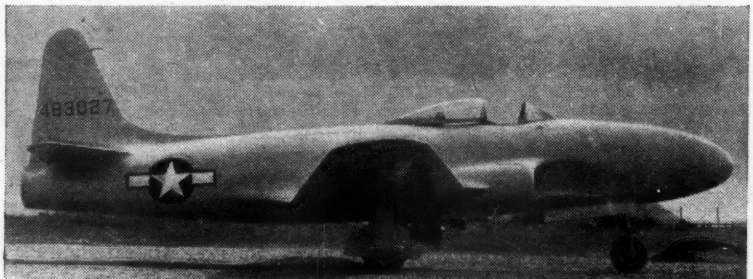
CONGRATULATIONS will be extended to our American cousins on their splendid new record figures established by a pure jet-propelled Lockheed Shooting Star fighter. To have raised the British figure of 616 m.p.h. to 623.8 m.p.h. (subject, of course, to the figures being officially confirmed by the F.A.I.) is an achievement of which manufacturer and pilot may be proud. It is indicative of the progress that America is making with her turbo jet-propelled aircraft, notwithstanding a comparatively late start. Personal congratulations are extended to Mr. Clarence L. Johnson, chief research engineer of Lockheed, Mr. Hall L. Hibbard, vice-president and chief engineer, and those responsible for power plant development.

THE RECORD IN BRIEF

(Subject to homologation by the F.A.I.)

Average speed	*623.8 m.p.h.*
Speeds on four runs	*(1) 617.1 m.p.h.*
	(2) 614.7 m.p.h.
	(3) 632.5 m.p.h.
	(4) 630.5 m.p.h.
Aircraft	*Modified Lockheed P 80 Shooting Star jet fighter*
Power Plant	*Special Allison turbo-jet with water methanol injection and after burning*
Pilot	*Colonel Albert Boyd, U.S.A.A.F.*
Base	*Muroc Dry Lake in the Mojave Desert, California*
Date	*June 19th, 1947*

Little is yet known here about the special record-breaking Shooting Star, but it is reasonably certain that the "nostril" air intakes have been extended forward and enlarged in area, and that the thickness/chord ratio of the wing has been effectively increased by addition to the leading edge. The well-named Shooting Star (P-80) had a single Allison Model 400 turbo-jet and was assisted by the first use of water methanol sprayed through the screen of the compressor, and also by after burning of the exhaust efflux. This utilization of water methanol to cool the incoming air serves, in effect, as a refrigerator. A great quantity is used, more, indeed, than the fuel consumed, the mixture consisting of 40 per cent methanol and 60 per cent water. As much as 300 gallons is said to have been carried by the Shooting Star, sufficient for fifteen minutes' injection.



A standard Lockheed P-80 Shooting Star of the U.S.A.A.F. From this model the record-breaker was developed.

It must be borne in mind that the relationship between G/C. Donaldson's record of 616 m.p.h. on the Gloster Meteor IV and the speed of the Shooting Star is one of atmospheric temperature. The record speed in itself is, of course, an established fact, but temperature enters the picture by virtue of the fact that the speed of sound in air is dependent solely upon the temperature of the air, and the speed at which the Meteor and Shooting Star class can safely be controlled is, in turn, dependent upon the speed of sound in the obtaining conditions. Thus, in any new challenge by this country for the record—and we sincerely hope that our own great progress in the turbine field will again be demonstrated—we must attempt the record in a hotter climate than we enjoy in this country. By way of example, when the Meteor is flown at a Mach number of 0.81 (81 per cent of the speed of sound) the actual speed in terms of miles per hour will depend solely upon the atmospheric temperature. Thus Mach 0.81 at a temperature of 60 deg F is equivalent to a speed of 616 m.p.h., but at a temperature of −12 deg F it corresponds to a true speed of 570 m.p.h. Speaking simply, the position can be explained as follows:

1. Every airfoil has a critical Mach No. when the incidence of compressibility stall is likely to occur.
2. Mach No. is a figure expressed as a proportion of the speed of sound under local conditions obtaining.
3. Present day airfoils have a critical Mach No. of about 0.8 to 0.9. When this is reached the drag rises precipitously, the centre of pressure changes, and flying trim is upset. There may be severe buffeting of the control surfaces.
4. The speed of sound in air depends on the temperature. At 60 deg F this is about 760 m.p.h., but at −60 deg F it is only about 670 m.p.h. Therefore, at lower temperatures the critical Mach No. is reached at a lower forward velocity.
5. At sea level sonic speed is approximately 750 m.p.h. The temperature lapse rate is approximately 3 deg F for each 1,000ft above sea level. At an altitude above 40,000ft sonic speed may be as much as 100 m.p.h. less than it is at sea level.

The ambient temperature at Muroc at the time of the American record is not yet known, but let us assume it to have been in the region of 100 deg F. At this temperature the speed of sound is 796 m.p.h., and the new record speed of 623.8 m.p.h. is thus equivalent to a Mach number of 0.785. It will thus be seen that the Meteor's Mach number of 0.81 under the same conditions would give an equivalent speed of 644 m.p.h. In short, the answer to any future maximum speed attempt by the Meteor is a hot climate such as is offered at Khartoum and in Kenya, for example.

Artificial cooling of intake air

It must be appreciated that the aircraft structure and the turbo-jet are affected by high temperature in different ways. Although the performance curves cross over, the utilization of artificial means of reducing the temperature of the mass of air on its passage through the compressor may increase the thrust of the Derwents in the Meteor by as much as 500 lb. per unit. Thus, ample power will be available.

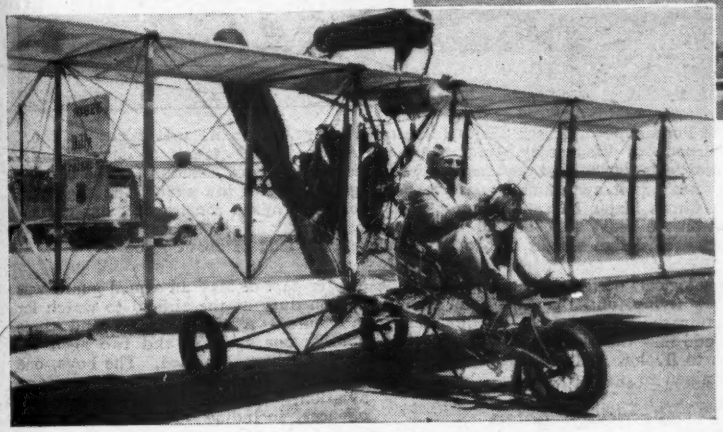
The foregoing remarks have assumed, with obvious justification, that the Meteor will be selected for the next British record attempt, but it must be recognized that this amazing six-year-old design will be limited by inherent design

(Concluded at foot of page 597)

Philadelphia's Show

New and Old at Memorial Day Week-end

A Jato take-off by a Douglas C-54G was one of the more spectacular and significant events. Below is Billy Parker's 1910 Curtiss.



ONE of the largest air shows yet held in Eastern U.S.A. was presented during the Memorial Day Week-end at Philadelphia, at the North-East Airport. The three-day show is reported by a correspondent to have been in the nature of a three-ring circus.

Great curiosity was aroused by a 1910 Curtiss pusher biplane demonstrated on each of the three days by Billy Parker, who has been flying in America for nearly forty years. The Curtiss is in very fine condition and is serviced by a special crew of mechanics. On the first day, while he was approaching to land, Parker's engine, a Gnome rotary, cut, forcing him to make a heavy landing and injuring a leg. His mechanics worked through the night, however, and the Curtiss was flying again the following day. The smell of burning castor oil, says our correspondent, brought back nostalgic memories of a period now a dusty dream.

Contrasting with the antique Curtiss were the P-82 *Betty Jo*, the Hawaii to New York record breaker; the B-29 *Pacusan Dreamboat*; Reynolds A-26B round-the-world *Bombshell*; and the Lockheed P2V *Truculent Turtle*, which flew from Perth, Australia, non-stop to Columbus, Ohio. Service aircraft included an experimental Liberator with both KDN-1 and KU3N-1 glider bombs under the wings, the new Douglas AD-1 attack aircraft, and the McDonnell Phantom Navy jet fighter. One Liberator was specially equipped to seek out storms, having radar installations and instruments designed to track down hurricanes and typhoons and to report their course to the Navy's Meteorological Bureau.

The fastest jet fighter was the Thunderjet. A squadron of FP-80A Shooting Stars flew over from Langley Field and did aerobatics singly and in various formations. Available for inspection were two particularly interesting photographic reconnaissance machines—the Northrop Reporter and the Republic Rainbow (XF-12).

Struggling bravely for attention amongst private-owner types were products of Piper, Aeronca, Luscombe, Beechcraft, Bellanca, Erco, Republic and North American.

THE WORLD SPEED RECORD

(*Continued from previous page*)

characteristics. The Americans, on the other hand, may soon be able to attack the record with jet fighters of more recent design than the Shooting Star (notably the Republic P-84 Thunderjet) and with the Douglas Skystreak transonic research aircraft. In function, though certainly not in design as it has straight wings, this Douglas is akin to the D.H. 108. This type, with its swept-back wings, may yet recoup for Britain a record which, at our present stage of technical development, must be assessed as of fundamental importance, not only in the matter of prestige but in the promotion of export sales.

The latest information available as this goes to press throws some interesting sidelights on the American trials. Pink smoke flares at each end of the course guided Colonel Boyd and a 12ft-wide strip of tar on the blazing white sand of the lake bed assisted him in adhering to the prescribed course.

THE CAEN RALLY

THE Aero Club de Caen et du Calvados was the host to twenty-three members, associate members and friends of the Royal Aero Club, who attended the "Products of Normandy" rally on Saturday and Sunday, June 14th and 15th.

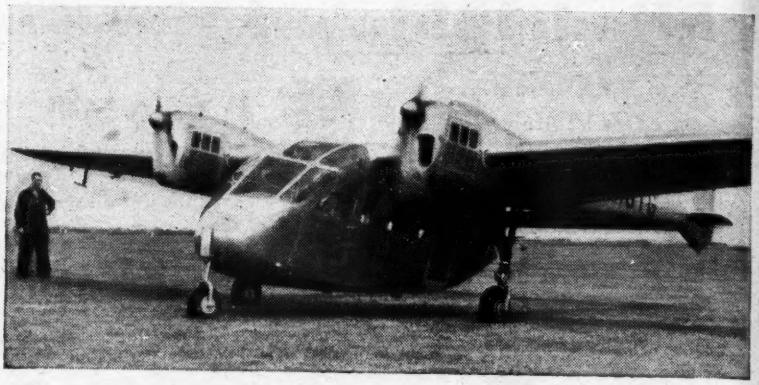
After a fine week it was disappointing to see the weather break on Saturday, but despite heavy showers, low clouds and a very unsettled "further outlook," a Percival Proctor, a Percival Q.6, a Moth Minor and six Austers made a safe crossing to Carpiquet airfield, where great preparations had been made for their arrival. Although the arrival competition which was on the programme did not take place owing to the bad weather conditions, each visitor received a generous gift parcel containing products of Normandy.

After the arrival of the last aircraft from Britain, the visitors were taken on a tour of Caen, and later, at a reception given in their honour M. Jaussard, president of the Aero Club de Caen et du Calvados, paid a sincere tribute to the part the British had taken in the liberation of Normandy, and also to the support that the Royal Aero Club was giving to civil flying. G/C. C. S. Morice, D.S.O., M.C., who, incidentally, commanded the first airfield to be established on the Normandy beach-head after D-Day, and who was representing the R.Ae.C. at the rally, replied to the toast. Amongst the speakers was Colonel Livry Level, who gained the D.S.O. and D.F.C. with R.A.F. Bomber Command, and is now a member of the French senate and chairman of the French Civil Flying Committee.

The weather for the display on Sunday was fair, and the day commenced with an Anglo-French "sweep" over Caen. In the afternoon a strong breeze made the gliding demonstrations and parachute jumps rather exciting. There was a creditable turn out of French aircraft and two German Fieseler Storch machines which were built by Morane-Saulnier at their Puteaux factory during the German occupation were present.

The highlight of the afternoon's events was the exceptionally polished performance of aerobatics given by M. Blanc flying a French Stamp aircraft. Most of the British contingent left reluctantly during Sunday afternoon, a few surrendering to the hospitality of Caen until Monday. Members of the Royal Aero Club are grateful to their hosts in France for a most entertaining week-end.

HERE AND THERE



The Portsmouth Aerocar Major, illustrated above, made its first flight on the afternoon of Wednesday, June 18th, and an early appreciation of its handling characteristics was that the machine performed well up to expectations. The Aerocar has a 42 ft. span and carries five passengers including the pilot. The engines are Cirrus Major IIIs. This prototype which is of mixed construction has come out on the heavy side, but all-metal production versions are expected to conform to design weight and to have a disposable load of about 1,500 lb.

Luton Meeting Off

THE Luton Flying Club regret that their meeting scheduled to take place on June 28th and 29th has had to be cancelled. Instead, the club is joining with the United Services Flying Club in giving a display at Gransden airfield on July 5th.

Facts and Figures

SOMEONE has been busy working out statistics for the Swedish A.B.A. company. According to reports the total distance flown by the company's aircraft since its formation twenty-three years ago is 34,577,057 kilometres—or 850 times round the world. 896,818 passengers are stated to have been carried up to June 2nd.

Expanding

THE first two of a fleet of seven Vickers Viking aircraft ordered by Aer Lingus were delivered to the company recently. When the fleet is complete Aer Lingus are hoping to open up new routes to Brussels in conjunction with Sabena. It is also expected to open a reciprocal service with K.L.M. to Amsterdam via Manchester, and a service linking Dublin, Belfast and Liverpool as well as a "feeder" service from Shannon airport to London.

The Low-down

HEDGE hopping sites—special low-flying areas are to be provided in Australia's Civil Aviation plan. Provision is being made to exempt these areas from low-flying clauses of the Air Navigation Regulations. The idea is psychological, designed to take the gloss off low flying, and the Australian Civil Aviation department take the practical attitude that there are times when pilots have to fly low and they might as well be trained to do it properly.

Parasite Fighters

THE latest idea in connection with the B36, the world's largest bomber, which is being delivered to the U.S.A.A.F., is to carry inside the huge fuselage a parasite fighter, the XP85. If attacked by enemy fighters during a long-distance raid, the fighter would be lowered through a trap in the base of the B36, cast clear in a steep dive and after dealing with the enemy it would return to the bomber. After hitching on to a specially designed hook it would then be hoisted inside the mother craft.

Juvenile Destruction

THE mystery of damage done to aircraft and property at Biggin Hill R.A.F. airfield was cleared up recently at Bromley Juvenile Court. During the greater part of May an armed guard was put on duty at the airfield to watch for saboteurs. A trap was set and three youths, one aged 16 and two aged 15, were caught red-handed. The boys, one of whom it was stated, was "mad on aviation," pleaded guilty to various offences, including £250 damage to an aircraft owned by S/L. Kellett; £100 damage to the power house; £20 damage to the flying control tower and £80 damage to the broadcasting room.

Boeing Contract

THE Wichita division of the Boeing Aircraft Company, N.Y., has received an order for ten million dollars worth of spare parts for the servicing of Army Air Forces B29's throughout the world. Work on the B29 spares contract is to start immediately and deliveries will extend over a period of two years.

Business "Picnic"

WHEN Major M. E. A. Wright, director of the Fairey Aviation Company, was in France recently he invited three leading French aviation officials to lunch in England and inspect the Fairey guided missile. When they mentioned the travel problems, Major Wright undertook to send the firm's Rapide aircraft to Paris to pick them up in the morning, fly them to Heston for lunch and return them to Paris in the afternoon. The invitation was not, however, entirely guileless; Major Wright blandly regretted that food restrictions caused English fare to fall short of French gastronomic standards and invited the Frenchmen to bring their own wines and special delicacies. The idea of a business picnic vastly tickled the Frenchmen who were due to arrive for their lunch in the director's dining room at Fairey's factory earlier this week.

Radar at Blackpool

THE first opportunity for large numbers of the public to see the radar set H2S, which shows a picture of the ground over which an aircraft is flying, will be provided in the exhibition at the Blackpool Air Pageant (see *Flight*, May 29th), which opens at Squires Gate airport on Wednesday, July 2nd. Bomber Command used this radar apparatus in attacks on German industrial centres and

"Flight" photograph.

THE ROCHESTER CHARTER FLEET: Proctors, a Dragonfly and the Avro XIX. In the background is the club house, clearly due for ultimate enlargement. A description of the inauguration of the club and charter service appears on page 605.

it often enabled Pathfinders to put down flares to mark targets on nights of thick cloud. The screen showing the radar picture will be lit up as on operations, and visitors will be able to see on it a view of the Channel Islands and the invasion beaches as they appeared to the aircraft crews flying over in the dark on D-Day.

Paratroops for Algiers

MORE than fifty paratroopers left Liverpool recently to assist in training French airborne troops in North Africa. Their headquarters will be at Algiers.

Heathrow Interest

SINCE the opening of the Heathrow public enclosure (announced in *Flight*, June 5th), there has been an average of 1,000 daily visitors and 4,000 Sunday visitors to watch the arrival and departure of aircraft from all over the world.

Linen Scoop

ENTERPRISING plans have been laid and carried out recently by a Bournemouth store in an effort to scoop the American market which is taking nearly 100 per cent of Ireland's fabric export. Pure Irish linen, 4,000 yards of it, was flown from Belfast to Hurn airport at the request of the store, and was on sale the day after it left Ireland. The firm concerned are hoping to run a shuttle service between Belfast and Hurn to transport Irish linen to this country.

High Spirits

CAMPERS at the Butlin's holiday camp at Pwlheli, which was opened this year, will be able to have an aerial view of the camp if they take a trip in one of the four Fairchilds which will be in operation for pleasure flights at the end of this month, on a landing ground only a mile from the camp.

The company also have a Dragon, a Consul, a Proctor and a Martlet and joy rides with Austers are being organized at some of the other camps.

A.T.C. "Bomber"

INGENUITY is the keynote of No. 161 (1st Highland) Squadron of the A.T.C., who are using a "synthetic" trainer built by one of the squadron officers. The trainer is a replica of a modern bomber complete with all the instruments of a real aircraft. It is fitted with W/T and R/T.

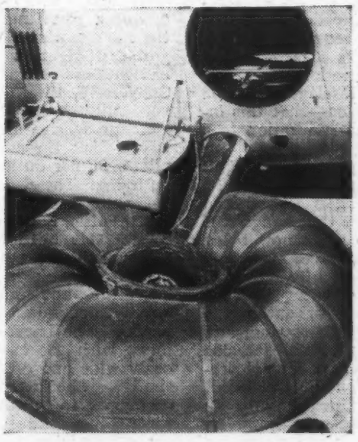
HERE AND THERE

"Noises Off"

PILOTS of aircraft using London Airport will be burdened with more pieces of paper when they receive maps showing the location of British Film Studios, and are asked to avoid flying over this area if possible. Nettlefold Studios have complained that the noise of aircraft flying overhead has been adding £200 a day to production costs.

New Police Technique

TWO police inspectors who accompanied a *Daily Express* photographer in a Westland Sikorsky helicopter, whilst engaged in a hunt for an armed desperado, are reported to have stated that every police force should be equipped with machines like this. The helicopter flew lower than tree-top level and covered more ground in fifteen minutes than fifty men on foot could cover in a day.



DOUGHNUT: This new emergency floatation gear around the wheels of a helicopter enables it to land on water or marshy ground. The "pontoon" is collapsible and does not interfere with normal wheel landings when not inflated.

Outsize Freight

WHAT is believed to be one of the largest pieces of machinery ever carried by an aircraft, was transported recently by a Bristol Freighter operating in South America and servicing the oil wells of Ecuador. The machinery was a component of an oil well drilling rig, weighing 7,300 lb. It measured 18ft in length, was 6ft 8in in height and over 6ft wide. It was loaded into the hold of the Freighter by running it on 3in steel rollers, and when it was finally in position there was only one inch to spare between the top of the rig and the fuselage roof. Transportation of this equipment in one piece is estimated to have saved the Shell Co. about 15,000 dollars.

Time Factor

A LETTER received from Athens well illustrates the advantages in employing air transport for freight delivery. A business firm found it vitally important that fifteen bales of worsted cloth reached Athens in the shortest possible time to avoid paying extra duties involving many thousands of pounds which would otherwise have been necessitated by a forthcoming rise in import duty. The cloth was loaded on board a B.E.A. aircraft at Northolt one morning and arrived in Athens before nightfall.

News in Brief

C.A.V., Ltd., of Acton, London, have appointed Mr. Norman Biles, A.M.I.Mech.E., A.R.Ae.S., as publicity and advertising manager. Mr. Biles has long been connected with the engineering and aircraft industry and was associated with Blackburn's for a number of years.

* * *

The Commonwealth Government of Australia have appointed Mr. Hanford Stevens as United Kingdom representative of the division of Aircraft Production — Ministry of Munitions. Mr. Stevens was formerly of the Bristol Aeroplane Company, Ltd.

* * *

Four bulls crossed the Atlantic by air when they were flown from U.S.A. to be exhibited at the International Fair in Milan.

* * *

Mr. T. L. Horabin, M.P., who was injured in the B.O.A.C. Dakota crash at Stowting, Kent, took to the air again when he flew from Northolt to Switzerland recently. He was wheeled to the aircraft in a bath-chair.

* * *

R. Malcolm, Ltd., aircraft engineers, announce a change of name. In future the engineering and plastic shops of the company at Slough will be known as M.L. Engineering Co., Ltd., and the design and experimental works at White Waltham as M.L. Aviation, Ltd. Personnel remain the same.

THE PADDOCK: Gliders competing in the recent contests at Oerlinghausen, organized by the Association of B.A.F.O. gliding clubs and described in *Flight* of June 12th.

Gold Plate Constellation

First of New Model 749 to Visit England : Inaugural Round-World Service Flight

INAUGURATING Pan American Airways' new round-the-world scheduled service, the model 749 Gold Plate Constellation, *Clipper America*, landed at London Airport on June 18th. As notified in *Flight* last week, this inaugural flight had as passengers eighteen leading American publishers, together with the Mayor of San Francisco and Juan Trippe, president of P.A.A.

This was the first 749 Constellation to be seen in this country, and an attractive aircraft it is. The Gold Plate series are fitted with C18-BD1 Wright Cyclones of 2,500 h.p. for take-off, these units employing direct fuel injection. Reverse pitch, root-cuffed airscrews give negative thrust braking. The gross weight has increased to 102,000 lb from the standard Connie weight of 90,000 lb, and 1,000 gall extra fuel capacity is embodied in outer-wing tanks. These increases respectively permit far greater payload for the transatlantic service and a step-up in range of about 1,000 miles.

Passenger accommodation in the aircraft examined comprised 42 chairs or 20 sleeping berths, but any desired layout can be adopted according to operators' requirements. A unique feature is that the accommodation is arranged in a "cabin-within-a-cabin," the whole of the interior being supported on rubber cush mountings inside the fuselage shell. It is claimed—we should imagine with justification—that this ingenious arrangement reduces interior noise and vibration to a very low level.

Pressurization to a differential of 4.75 lb/sq in gives an equivalent cabin altitude of 8,000ft at an actual altitude of 20,000ft, and the general cabin atmosphere conditioning is a good deal better than in the standard Constellation, since the change rate of cabin air has been doubled, a complete change now being given every 70 seconds. Twin Janitrol heaters of improved type cater for cabin heating, this being provided by means of radiant warm-wall panels, the warm air circulating between the cabin shell and the enclosing fuselage. Air enters the cabin through perforated grilles at wall/floor intersection, and vitiated air is extracted through perforated panels on each side of the central lighting strips in the roof. Cabin cooling is provided by a small air-turbine refrigerator which, it is claimed, will maintain an interior temperature of 70 deg F with an external temperature of 100 deg F. It is necessary, however, that one of the Wright Cyclones be run at 1,250 r.p.m. to operate the turbine cooling plant—a possible disadvantage at a tropic airport, where ground-conditioning trucks would appear to offer considerably less inconvenience.

Speedpak external freight carriers are available for Gold Plate Constellations, and it is worthy of note that, for example, over such a range as Amsterdam-London a Speedpak will accommodate a similar low-density load as that capable of being carried by a DC-3, and will entail an increased fuel expenditure of but 30 gall.

The *Clipper America* arrived on three engines, the starboard outer having developed roughness shortly after leaving Shannon. These Constellations can, however, maintain an altitude of 8,000ft on any two engines. Top speed with full load is over 350 m.p.h., and cruising speed at 67 per cent power is over 320 m.p.h. Useful load is given as over 18 tons, and the maximum range with normal reserve fuel unused is in excess of 4,600 miles. A range of over 2,000 miles is possible with a 10-ton load.

Accommodation Details

Forward of the main passenger cabin is an all-electric galley which is well planned and comprehensive. Beyond this is the crew rest room equipped to starboard with four chairs in opposing pairs and with a fold-away roof berth. To port is the navigator's station furnished with an efficient desk and a gyro-drift-sight, but exhibiting an almost complete lack of navigational instruments such as we are accustomed to expect. Conversely, the radio operator—seated behind the captain—is very fully equipped, and opposite him the flight engineer has a comprehensive array of instruments and controls; in fact, it is said that the engineer takes over about 60 per cent of the pilot's former duties, so leaving him free to concentrate solely on flying. The cockpit is so cluttered as to appear cramped.

Passenger chairs are arranged in pairs on each side of a central aisle, and are adjustable for recline; they are admirably comfortable, but for a tall person—over a lengthy period—there is insufficient leg room. The upper berths stow away very neatly at an angle of about 40 deg on each side of the roof curvature, but unfortunately reduce the sectional area to a point which might prove distressing to even a mild claustrophobe. The backs of alternate rows of seats hinge down to form, with the cushions, the lower berths; these are generously wide and 6ft 6in long. Upper berths are dimensionally similar. The latter are fitted with individual windows in the surrounds to which are incorporated reading lights, electric razor plugs and steward call buttons. Hinge-down shelves concealing mirrors are fitted to the walls, together with swing-down tables. Lower berths are equally well furnished.

Ample wardrobe and personal baggage accommodation is provided at the rear of the cabin, and in the extreme tail is the nicely furnished powder room for the ladies. The male's compartment is equally well laid out up forward.

TURBINE FUELS AND OILS

AN informative lecture on "Fuels and Lubricants for Aero Turbines" was given by Dr. C. G. Williams, Director of Research at the "Shell" Aero Engine Laboratory, Thornton (described in *Flight*, April 2nd, 1947), to the Luton branch of the Royal Aeronautical Society on June 4th.

Stating that the subject was a relatively new one, Dr. Williams emphasized that at present combustion is largely influenced by mechanical and aerodynamic factors. Whilst there existed a fairly widespread impression that the gas turbine could be operated on almost any liquid fuel, the search for higher efficiency and better performance may bring certain fuel properties into prominence. All fuels normally contain water in solution which cannot easily be removed. This was liable to cause corrosion and was the reason for the recent practice of adding 1 per cent of lubricating oil to the fuel mainly to act as a corrosion inhibitor. It is confidently expected, however, that in the near future neither kerosene nor gasoline fuels will require added lubricant.

Water Solubility

With a consumption of 1,000 gall/hr the quantity of water involved is approximately 0.04 gall/hr, and a fall in temperature to −10 deg C or lower results in precipitation and may result in the clogging of cloth filters. In general the heavier fuels—gas oils—have a lower water solubility than the lighter fuels—gasolines—while the kerosenes occupy an intermediate position. Ice clogging can be delayed by a preceding 100-mesh gauze filter or eliminated by addition of 0.5-1.0 per cent of an alcohol anti-freeze agent which depresses the freezing point to −50 deg C.

Filters may also become clogged by wax formation. Both Britain and U.S.A. initially specified a "cloud point" of −60 deg C, but, the availability of such kerosenes being limited, the British figure was raised to −40 deg C. It must be remembered that at a forward velocity of 600 m.p.h. a temperature rise of 36 deg C is possible on aircraft leading surfaces.

In the section dealing with combustion the interesting conclusion was drawn that flame extinction at weak mixtures is liable to occur in units having a plurality of chambers, while other engines having an annular chamber are inclined to suffer from rich blow-out. Under high air flow conditions kerosene has a better weak blow-out limit than iso-paraffinic and iso-octane fuels. Conversely, under low air flow and poor atomization conditions increased volatility is beneficial and gasoline will be better than kerosene.

As regards fire risks, Dr. Williams considered that the usual type of aircraft fire would not occur with kerosene, but the risk of explosion in fuel tanks was greater than with petrol.

A matter of great importance for the future is the question of availability. At present kerosene amounts to about 5 per cent of the total production of liquid fuels and is largely allotted to backward countries for lighting and heating. The largest available supply is petrol. He suggested a distillate fuel of low viscosity and high volatility would offer advantages in relation to atomization, cold starting, blow-out and carbon deposition and could be made available in large quantities.

POWER FOR THE PLANES OF TO-MORROW

MAMBA

Gas Turbine Propeller Engines

ARMSTRONG SIDDELEY MOTORS LTD

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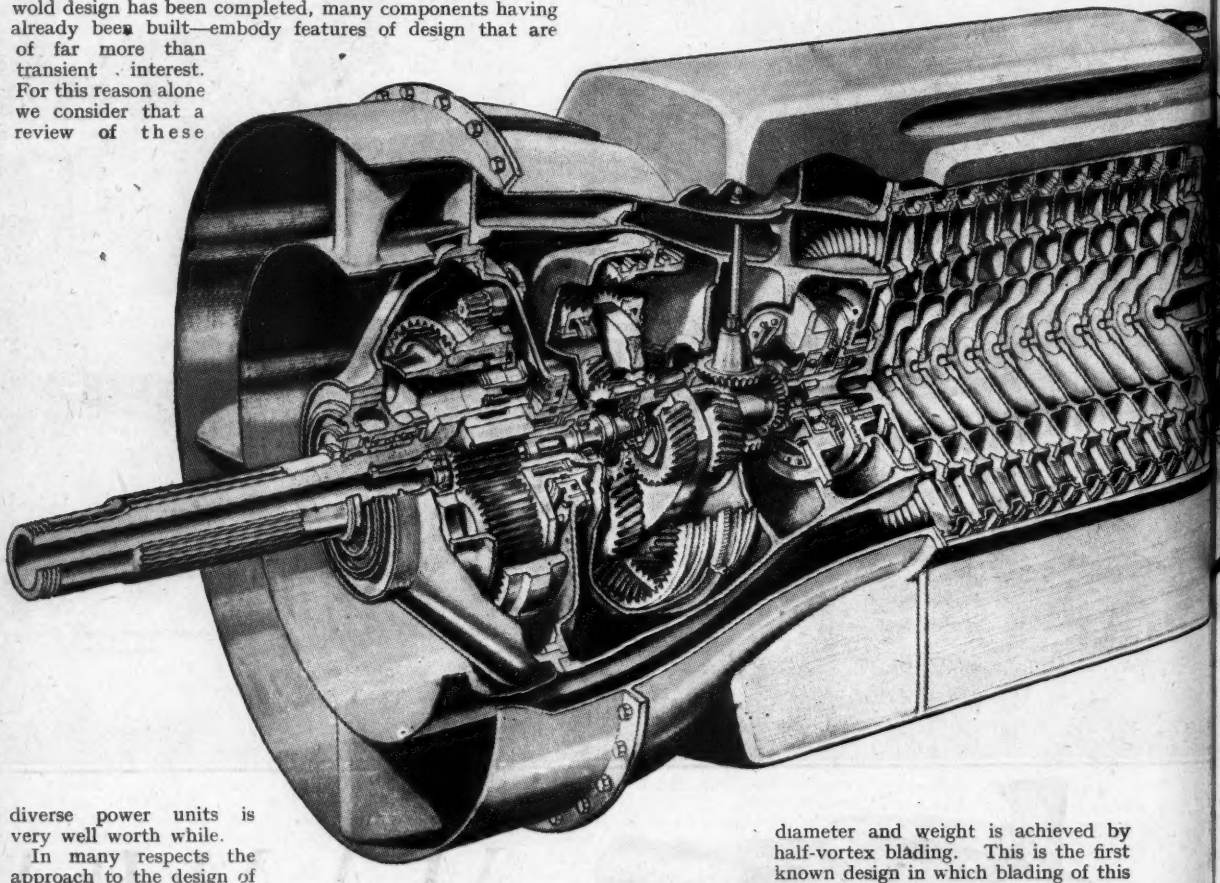
FEDDEN POW

Design Details of the Cotswold Airscrew-T Aircraft Engi

IN our last week's issue we included a review of the past history and development organization of Roy Fedden, Limited, giving, at the same time, the unfortunate news that the country's financial stringency had led to the cancellation of the Ministry of Supply contract for development of the Cotswold airscrew-turbine. This, of course, implied no criticism of the company's work; on the contrary, the Ministry had nothing but praise for the very fine job Roy Fedden, Limited, had done. It is doubly unfortunate that, almost at the same time, the current recession of building programme applicable to most aircraft manufacturers in America led to the cancellation of the Erco concern's contract for development of the Fedden flat-six. We may reiterate the hope that, although these two interesting power units may be lost, the very valuable research and development unit Sir Roy Fedden has built up may not be dissolved entirely. In our present circumstances—taking an international view—we can ill afford to lose keen and able teams of technicians, least of all in the aviation field.

Novel Design Features

Both of the engines being developed—the flat-six has run some considerable number of hours, whilst the Cotswold design has been completed, many components having already been built—embody features of design that are of far more than transient interest. For this reason alone we consider that a review of these diverse power units is very well worth while.



In many respects the approach to the design of the Cotswold airscrew-turbine has been quite original, and it is true to say that among those who have examined the basis of the design there is unanimous agreement that advances should be given in power/weight ratio, fuel consumption and low drag. Careful attention has been given to the layout of fuel, lubrication and electrical systems, both to ensure their accessibility and to place them where they are least likely to start or aggravate fire: it is for the latter reason especially that oil and fuel are carried in passages in the engine castings instead of by the more usual pipes.

From the installation and maintenance viewpoint a determined attempt has been made to design a clean and serviceable installation. The employment of grouped connections and a four-point attachment is designed to facilitate engine changing in a rapid and simple manner.

The eleven-stage axial compressor has a compression ratio of 5.75: 1 which, it is believed, is the highest yet attempted in a purely axial design. This is to ensure a low fuel consumption, probably of the order of at least 5 per cent lower than can be expected with a compression ratio of 5: 1. For the rotational speed, which is dictated primarily by the design of the two-stage turbine, the most efficient compressor as regards temperature rise, diameter and weight is achieved by half-vortex blading. This is the first known design in which blading of this form has been employed. The last stages employ higher stagger angles (40 deg) than are thought yet to have been attempted and, in addition, the inlet Mach number to the first-stage rotor blades at the centre line is 0.7. This is claimed to be 0.05 higher than that employed on existing designs. The exit velocity from the compressor is but 300ft/sec; this low velocity was adopted in order to improve combustion efficiency.

The high rotational speed of the rotor demanded a compressor design incorporating the highest possible radial strength together with a high order of axial rigidity.

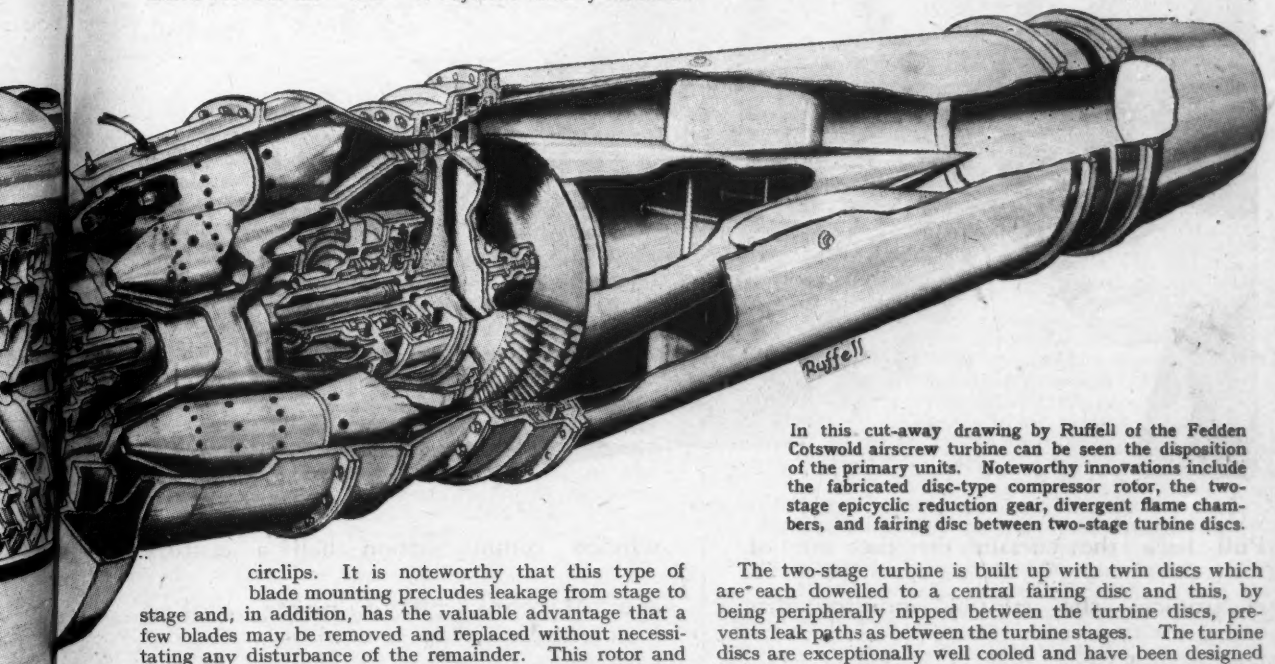
POWER UNITS

d Airew-Turbine and the Flat-Six Light ircraft Engine

It was considered, in view of these requirements, that neither the drum nor the usual disc type of structure was suitable, and a combination of the two forms was necessary. To accomplish this without an extravagant expenditure of weight presented a difficult problem; however, the solution found was both simple and novel. The compressor rotor is a fabrication of concentrically flanged steel discs registering each within the other and furnace-brazed together. Rotor blades are root-shouldered and are retained between the "rims" of adjacent discs by means of circlips. It is noteworthy that this type of blade mounting precludes leakage from stage to stage and, in addition, has the valuable advantage that a few blades may be removed and replaced without necessitating any disturbance of the remainder. This rotor and blade system is believed to be the first to be constructed entirely in steel, it now being acknowledged that this is, in fact, lighter than a light-alloy structure having the same mechanical strength characteristics.

Roy Fedden, Limited, did not share the general optimism regarding the low cost of the gas turbine, and a great deal of the design effort put into the Cotswold was directed toward reducing the cost of blades. An interesting production development successfully allows the stator blades to be cut from a drawn strip of extremely accurate profile and superlative finish. In conjunction with Wellworthy, Ltd., a method was evolved whereby the blades are then cast integrally with the carrier rings, which are simply clamped-up axially to form the stator drum. This feature of producing blades virtually as a continuous process not only reduces the cost of materials and work per blade from about 15s to fivepence, but also entirely eliminates the machining of the blade root and the socket in which it is fixed. It is calculated that this development alone would reduce the cost of the stator assembly from more than £1,000 to approximately £100.

Discharge from the compressor is into an annular shroud chamber in which are housed the seven combustion flame tubes. Contrary to the established practice of flame tube design employing a convergent form, the Cotswold combustion tubes are of expanding, or divergent, longitudinal section, this being a means of ensuring a low gas speed through the chamber. Fuel is injected upstream from the nozzles, and primary combustion air is admitted around the chamber head whilst secondary air is admitted through two rows of holes in the central trunk, this being supplemented by cooling, or dilution, air introduced through a single row of holes in the divergent portion of the tube upstream of the outlet cone. The unique expanding mixer section of the flame tubes reduces losses, and it has been confirmed by tests that the combined loss factor of this combustion system is only 4 per cent, a distinctly creditable figure if attained in practice. The maximum combustion temperature of 1,185 deg Kelvin (913 deg C) is as high as present material developments can possibly justify. This high working temperature was selected with the object of increasing specific power output by at least 10 per cent, and is in excess of normal standards applying to modern gas turbines.



In this cut-away drawing by Ruffell of the Fedden Cotswold airscrew turbine can be seen the disposition of the primary units. Noteworthy innovations include the fabricated disc-type compressor rotor, the two-stage epicyclic reduction gear, divergent flame chambers, and fairing disc between two-stage turbine discs.

The two-stage turbine is built up with twin discs which are each dowelled to a central fairing disc and this, by being peripherally nipped between the turbine discs, prevents leak paths as between the turbine stages. The turbine discs are exceptionally well cooled and have been designed for the high rotational tip speed of 960ft/sec in order to provide a very high absorption of work from only two stages. The effect of this is appreciably to increase the take-off power of the engine, the difference between a temperature drop through the turbine of 300 deg C and 330 deg C being an increase in effective shaft horsepower from 1,230 to 1,425.

Turbine Characteristics

To achieve this remarkably high rate of 330 deg C heat-drop between the first and second stages, the first-stage turbine blades are designed with a root camber of 120 deg, a figure which is 20 deg greater than that of any known design. In view of this and of the low aspect ratio, the blade design is of considerable interest as a technical development. Advantage has naturally been taken of the latest experience and knowledge of blade and disc materials to increase the root stresses to figures not hitherto attempted. From the turbine the gases are discharged down a 2:1 diffuser tail pipe, being exhausted to atmosphere at the relatively low velocity of 630ft/sec.

The turbine casing is of original design in that it is cooled and is constructed of low-expansion material developed at the instigation of the company. This should permit clearances between turbine blades and casing to be

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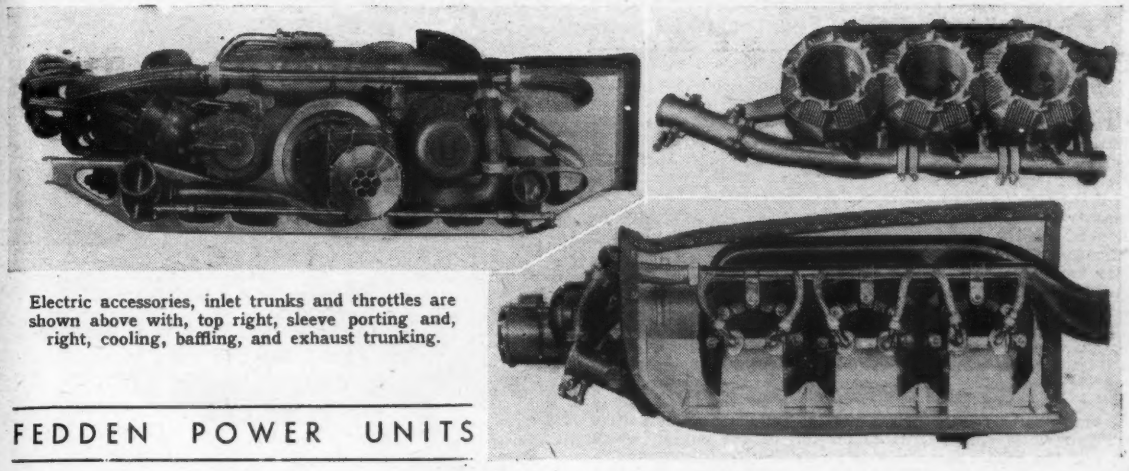


Electric accessories, inlet trunks and throttles are shown above with, top right, sleeve porting and, right, cooling, baffling, and exhaust trunking.

FEDDEN POWER UNITS

reduced considerably: a very important point in a small unit. The design of the turbine casing is arranged so that, contrary to normal practice, the torque reaction stresses are not transmitted through the nozzle blades. The construction of the turbine provides for easy removal of the assembly as a complete unit, and on removal the flame tubes are fully exposed for inspection and replacement without removing the shroud casing.

The reduction gear ratio of 14.785 : 1 is believed to be the highest yet attempted. A compound epicyclic type reduction gear is employed, and a special feature of the design is that there are no highly stressed intermediate shafts susceptible to torsional vibration. The high-speed gears have double helical teeth, and they are mounted in a novel manner so as to ensure symmetrical loading both of the gears and their mountings.

The compressor shaft is splined to a doubled sun wheel which meshes with three fixed planet pinions: these, in turn, mesh with an internally-toothed annulus carried in a bell housing. This comprises the first half of the reduction gear. The bell housing has a splined hub to transmit drive to the sun wheel of the forward, or second, half of the reduction gear. In this part of the transmission the sun wheel meshes with three planet pinions which are carried on the airscrew shaft, reaction being through their engagement with a fixed enclosing annulus.

Rotation of the airscrew is opposite in direction to that of the rotor system, and this has the effect of reducing the torque and gyroscopic loads on the engine mounting by 12 per cent and 33⅓ per cent respectively.

A hydraulic torque meter is embodied in the reduction gear to register torque-failure warning and, at the same time, to institute automatic feathering of the airscrew.

The Flat Six

Like the Cotswold, the 5.3-litre flat-six Fedden engine has many interesting design features, perhaps the chief of which is that it was conceived from the start to be completely submerged in a wing. In actual fact, the wing profile was imposed before a single line was made on the drawing boards. This principle requirement has been the guide in the whole design, and in terms of general layout has imposed strictures which have left little freedom to the designer. Conversely, this procedure being followed from scratch has enabled the production of a simple layout with excellent accessibility to all accessories and other items requiring checking or adjustment.

The engine has been designed basically to drive a pusher-propeller through a suitable extension shaft. A single spar wing layout had to be adopted for the aircraft. Although the main stresses are carried by the substantial single spar a certain proportion of the torsional stress has to pass through the engine cowling. This is of stainless steel to ensure sufficient resistance against possible fires, and special quick-acting fasteners have been developed which permit the cowling to act as an integral part of the wing shell.

It was intended to use the present design as a basis for further developments, notably for an exact replica of this engine fitted with British accessories. Further plans were prepared for this engine to be used in a simple tractor form mainly for fuselage installation. A geared version of a substantially increased rating was also envisaged.

Detail Design Features

The main detail design feature of the engine is the vertical finning of the cylinder barrels. The cardinal prerequisite for a successful air-cooled cylinder, particularly when sleeve valves are used, is a uniform temperature distribution over the barrel, and from this viewpoint it is now generally acknowledged that vertical finning presents considerable advantage. In this engine the improvement obtained was striking, and the bearing pattern of the sleeve in the cylinder is very much better than that obtained with conventional finning. In addition to this the carefully distributed air flow ensures very low barrel temperatures with minimum cooling air consumptions. Hundreds of hours of single cylinder running have confirmed the expectations.

Serrated bearing cap faces are used.

The cylinder barrels are cast in low expansion silicon aluminium alloy and are each attached to the crankcase by six studs. The three cylinders of each bank are held together at the base by miniature turnbuckles, and each set of three cylinders is normally handled like an integral block and is not disturbed during assembly or stripping of the engine. This ingenious design proved to be a success from the beginning.

The three inlet ports and two exhaust ports are so designed that they can be fully machined from the outside of the barrel, and some interesting work has been done on air flow rigs to refine the port design in both barrel and sleeve to achieve the very best gas flow conditions. A special small banjo casting is inserted between the opposing side inlet ports of adjacent cylinders, being held in place by small dowels.

The cylinder head is a single-piece aluminium alloy die casting, also in low expansion silicon aluminium. The flame crown of the cylinder head is quite flat and the sparking plug positioning has been spread as much as possible to ensure an efficient and unobstructed air flow. Detonation-free running has been obtained at an 8 : 1 compression ratio on 90 octane fuel with very good powers and consumptions.

The cylinder head is fixed to the barrel by means of ten studs, and spigots with a small collar into the barrel, the fixing flange being a separate dural forging.

FEDDEN POWER UNITS

Pistons are of quite orthodox design with four rings: one wedge type, two plain compression rings and a scraper.

The crankshaft is of conventional design with four main bearings and six crank pins. Pressure oil is supplied to both end main bearings, and all other bearings are lubricated from the oil passage in the shaft, precautions having been taken to de-aerate the oil for the middle bearings. Drive to the airscrew shaft is through a splined coupling rigidly bolted to the end of the crankshaft, this matching with a properly splined member on the airscrew extension shaft. Connecting rods are shot-peened steel and have serrated faces matching with the similarly serrated bearing cap face. Two high tensile steel bolts hold the assembly together. This particular design has been adopted to reduce the dimensions of the big-end as far as possible without losing the necessary rigidity. Thin-wall lead-bronze bearings are fitted in the conventional manner.

A very neat solution has been adopted for the general layout of the drives A spur gear is mounted on the front end of the crankshaft and drives two idler gears; these in turn drive the two worm shafts situated on top of the engine which embody the bronze worm wheels for driving the sleeve cranks. Pressure and scavenge oil pumps are driven from the free ends of the sleeve drive shaft and the gears in the pumps are so arranged that the correct speed for the magneto and for the accessory drive shaft is obtained without further gearing. The fuel injector is driven by a short vertical shaft from a skew gear located on one of the drive shafts.

The sleeve valves are of standard Burt McCullom type in nitrided high-expansion nickel manganese chromium steel and are 0.080 in thick. The driving lug forms an integral part of the sleeve and the bronze ball is located in the sleeve drive crank.

To improve the wear characteristics of the sleeve drive the two shafts rotate slightly faster than the crankshaft, the conventional artifice of a hunting tooth providing the necessary ratio. Both drive shafts are rifle-drilled and distribute oil supply to the whole mechanism. The sleeve drive cranks are case-hardened nickel chromium steel forgings with the ball seats and journal faces similarly case-hardened. A steel-backed bronze bush is pressed into the crankcase and forms the lower bearing of each sleeve crank. The top of each crank is supported in a neat magnesium spider, the crank running directly in the magnesium.

The couples produced by the reciprocating motion of the sleeves do not balance out and to compensate this balance weights are fixed to the cranks.

Crankcase Details

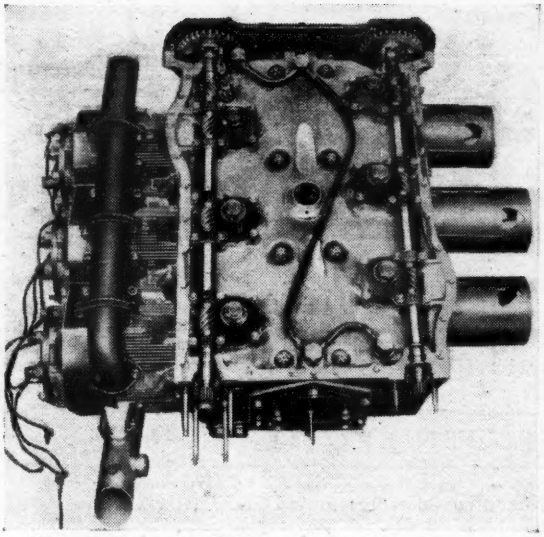
The crankcase is an aluminium casting and, contrary to general practice, is split in the horizontal plane, the halves being secured by eight through bolts adjacent to each main bearing, supplemented by peripheral studs. The stress path from the cylinder holding down studs into the main bearing caps has been very carefully worked out and generous fillets and ribs provided as necessary. This design provides the correct clearance for the bottom part of the sleeve and is, incidentally, more symmetrical than the conventional form of vertically split crankcases.

The main bearings are lead-bronze with relatively substantial steel shells. The parting line of the bearings is turned 90 deg. from the parting line of the crankcase in order to avoid the concentration of the heaviest loads on the bearing parting line.

A magnesium top cover encloses the sleeve drive mechanism and also forms a breathing chamber. A small magnesium casting on the base serves as the oil collecting sump.

In its basic form the engine is designed to drive a pusher-propeller which is supported on a tubular structure of light alloy sheet anchored to a substantial face which is provided on the crankcase cover plate. The extension shaft has splined couplings on both ends and is housed within the propeller support tube. The propeller shaft proper runs on independent ball bearings.

The cooling system is novel and forms an interesting conception. The cooling air enters through two slot apertures in the leading edge nose and fills a plenum chamber. Part of the air then passes over the crankcase and thence outward along the closely baffled cylinder barrels to the low-pressure chambers on each side of the engine. Suitable openings in the wing spar permit the evacuation of this air into the mixing chamber of the exhaust ejector. The remainder of the air in the plenum chamber is ducted direct to the individual cylinder heads from whence it reaches the same low pressure chambers as the main cooling air flow.



With one bank of cylinders removed, the sleeves themselves can be seen together with the neatly arranged sleeve drives.

The exhaust collector pipes are located in the low-pressure chambers which contain the spent cooling air. These chambers are well separated from the rest of the engine and there is thus the minimum amount of heat radiation from hot pipes. A pusher-propeller installation deprives the engine of the slip-stream and it was, therefore, necessary to assist the cooling air flow by the action of exhaust ejection. The exhaust collector pipes discharge into a tail pipe down which the gases and cooling air are finally exhausted to atmosphere at the wing trailing edge.

Fuel is admitted to the cylinders by direct injection into the centre port of each barrel. An American make Ex-Cell-O injector is mounted on the bottom face of the crankcase. This type of injector is becoming rapidly popular for light aero engines in the U.S.A. and is giving very encouraging results. This injector has an inbuilt fuel booster pump which dispenses with the necessity of using an additional supply pump.

A conventional dry sump system is used. The pressure pump is fitted with a relief valve and feeds the oil through a neatly housed AutoKleen filter into the lubricating system of the engine. The twin scavenge pump is of a special design, having only three gears instead of the usual four. Coarse gauze filters protect the scavenge pump from eventual damage by metal particles.

The starter and dynamo is a combined dyna-starter unit manufactured by the American EEMCO Company. A spur gear is fixed to the crankshaft and drives the unit, giving a speed increase of 3.5 to 1. The advantages of such a unit are obvious. There is not only a great simplification of the drive layout, but there is quite a saving in weight and cost.

Ignition is provided by one Eisemann type magneto having a fixed timing. This magneto is directly mounted on the oil pressure pump face and is driven at the correct speed from the oil pressure idler gear through a spline coupling. The second set of plugs is served by a standard Lucas coil ignition unit. The distributor is provided with an automatic spark advance specially arranged to retard the spark at cranking speeds. For emergency hand starting of the engine, the ignition switch is put to battery ignition only, thus eliminating danger of kick-back. This distributor takes its drive through a pair of skew gears and a small shaft from the scavenge pump idler gear.

ICELAND–DENMARK SERVICE

FOR more than a year Scottish Airlines have been operating a service from Reykjavik through Prestwick to Copenhagen, under charter to Iceland Airways, Ltd., and during that time 2,912 passengers have been carried. The company are flying two services to Copenhagen and three to Iceland each week, taking 3½ hr from Prestwick to Reykjavik and 5½ hr on the return flight, 4½ hr from Prestwick to Copenhagen and 2½ hr on the return journey. These flights are made with the 24-seater Scottish Airlines' Liberators.

Towards Happier Landings

Automatic Approach Control with Sperry Instruments: B.O.A.C. Trials in a Liberator

This Liberator which is, of course, a tricycle type, was used by the B.O.A.C. Development Flight in their automatic approach trials.

By F/L. T. TOWNSON

TRIALS held at Prestwick Airport during April and early May, and demonstrations before Government departments, experimental establishments and the principal airlines at London Airport on May 16th and 19th and June 6th, have shown for the first time, at least in this country, that automatic approaches to an airfield runway using commercial production equipment are a practical proposition. The trials were made by B.O.A.C. Development Flight in a Liberator using the Sperry A-12 Gyropilot and automatic approach control, and the SCS.51 Instrument Landing System.

Previously, as long ago as 1944, automatic approaches had been made in this country by Service units using the "Minneapolis Honeywell" autopilot and SCS.51 Instrument Landing System, but a senior R.A.F. officer who has had considerable experience with this tie-up, after flying with the Sperry equipment, said that their efforts did not attain the same degree of success. The development work on the Sperry equipment was carried out in the U.S.A. using both the SCS.51 and Sperry "Microwave" Instrument Landing Systems; with the latter system it is understood that about 100 successful landings have been made by a DC-3 aircraft flying-on at a 2½ deg angle of approach, but it must be emphasized that the system at present is designed for automatic approach only and not automatic landing.

IN "Flight" of October 31st, 1946, an illustrated description of the Sperry A-12 electrically-operated autopilot was presented under the heading "Towards Complete Automaticity." With that article F/L. Townson of the Sperry Gyroscope Co. Ltd. couples this description of the automatic approach equipment used by B.O.A.C's Development Flight in some recent trials

A complete radio landing system calls for directional and height references, and, ideally, the projection of two radio beams known usually as "Localizer" and "Glide Path" to indicate the direction of the runway in the horizontal and vertical planes respectively. These beams can be beams of radiated electro-magnetic energy or, as in this and the more usual case, "beams" of zero or minimum radiation between two radiated beams or space patterns. Since the Instrument Landing System (I.L.S.) is primarily for use under instrument flying conditions and, under those conditions, the pilot will need to know whether he has deviated to the left or right (of the localizer) or above or below (the glide path), the radiated energy on each side of the lane of zero or minimum radiation will need to be suitably modulated to provide the required discrimination.

The type of display of the intelligence received in the aircraft is of some importance and the I.L.S. cross-pointer meter with its instinctive presentation conforms to modern instrument presentation practice, the pilot (if flying manually) on approach, flying his aircraft "towards the intersection of the Localizer and Glide Path needles." The only difference between the standard SCS.51 and Sperry "Microwave" cross-pointer meter presentation lies in the pivoting of the indicating needles. Whereas the needles in the former instrument are pivoted each at one end only so that the needle movement is in a flat plane, the presentation in the latter instrument is more accurate in that the localizer needle is always vertical and the glide path needle is always horizontal (assuming a vertical and level attitude of the instrument panel, etc.). In addition, the needles are pivoted to move round the periphery of a sphere, and to be normal to one another at all times rather than in the central position alone.

The problems of automatic approach are very briefly these:—

(a) To establish a ground track along an imaginary, rectilinear, down-wind extension of the runway to be used.
(b) To establish a glide path at a suitable distance from the runway and at a predetermined angle below the horizontal, this glide path meeting the earth at the down-wind end of the runway.
(c) To trim the aircraft controls during the descent along the glide path so that, when the change-over from automatic approach to manual landing takes place, no rapid operation of the aircraft controls is necessary to maintain the attitude of the aircraft.

Since the localizer and glide path beams define the ground track and glide path, the problem is thus resolved into that of detecting the two beams by suitable receivers in the aircraft, and of using the detected signals to introduce appropriate control surface movements through the medium of an automatic pilot. The automatic pilot itself can be made to solve the third problem of automatically trimming the aircraft during its descent along the glide path, or at least an elevator trim indicator can be provided, so that manual trim can be effected during the let-down.

Before considering these problems individually, it is of value to consider the design of automatic pilot which will be necessary to effect their solution. The type which applies corrective control proportional to the amount of displacement of the aircraft in roll, pitch or yaw, operates accurately only over a narrow speed range of the aircraft in which it is fitted. Thus, for example, if this type of autopilot is to be used for automatic approach work then, since the aircraft during approaches is flying near the bottom limit of its speed range, the amount of control necessary to correct a given displacement will be greater than that needed to correct the same displacement at cruising speeds. The ratio of control to displacement is generally determined by the servo gear ratio and it is evident that the displacement type of autopilot could be used for automatic approach work but that it would need to be modified in flight before it could be used over the entire speed range of the aircraft. If the servo gear ratio determines the ratio of control to displacement, then it will be seen that an infinitely variable servo gear ratio would be needed between the ratios ideal for the upper and lower speed limits. If, however, the autopilot applies

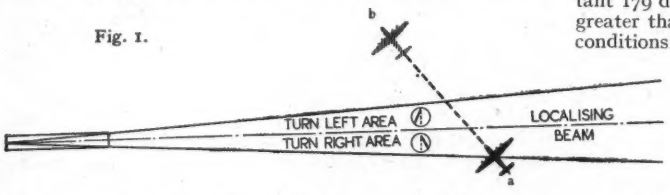
TOWARDS HAPPIER LANDINGS

corrective control which is proportional to both the displacement and the rate of displacement, then in effect this infinitely variable gear ratio is obtained.

The Sperry A.12 Gyropilot is a "displacement plus rate" autopilot, and is thus suited to automatic approach and, indeed, to controlling an aircraft at any operating speed without adjustment in flight, since correctly banked turns are made at all airspeeds within the operating limits.

To solve the first problem of establishing the required ground track, it will be apparent that if the aircraft can be positioned along it, then the signal which will be received to indicate any deviation can be used to instigate a suitable corrective turn. The received signal and the subsequent turn will be approximately proportional to the angular displacement of the aircraft from the track, and a pure displacement signal will probably suffice to maintain the ground track, but only after it has been established, i.e., at a small angle of intersection. An alternative system is to introduce a directional reference, but this may involve a more complicated procedure in that the aircraft must be flown parallel to the localizer beam for a certain distance or, at least, the runway Q.D.M. must be set on the compass.

Fig. 1.



Consider now the case of an aircraft intersecting the localizer beam at a positive angle of intersection from one side (Fig. 1). The localizer needle will indicate "Turn Right," and an appropriate signal will be fed to the autopilot, the subsequent course of the aircraft will be anything but that required and severe hunting about the beam centre will take place. Thus, by using a turn signal which is proportional to displacement from beam centre, the limitation is imposed that the angle of intersection of the beam must be very small. Now, if the rate of change of the displacement signal is measured and a rate "signal" produced, this can be suitably polarized (or phased) and combined with the displacement signal in such a way that appropriate turns can be introduced to establish the ground

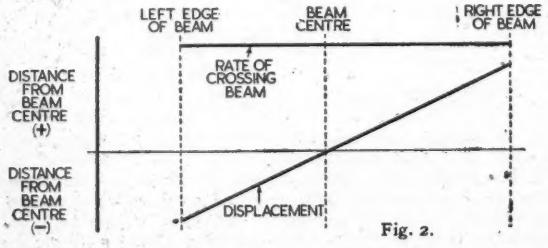
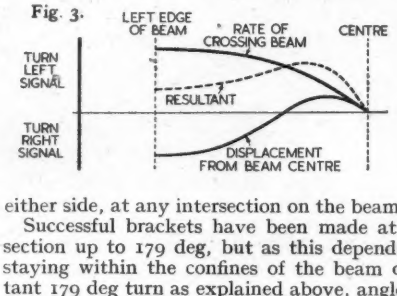


Fig. 2.

track along the localizer beam centre irrespective of the angle of intersection. This is subject only to the limitation that the aircraft must be within the confines of the beam at some time during the bracketing turns, otherwise, of course, the rate of cutting the beam will be zero.

As an illustration of this principle, take the case of the aircraft in Fig. 1, being flown manually across the beam along the track a-b. The displacement signal and the rate of crossing the beam are shown graphically in Fig. 2. If now the displacement and rate components are translated into turn-producing signals which are allowed to turn the aircraft, these signals will be of the order of those shown graphically in Fig. 3. If an ideal "bracket" of the beam is taken to consist of one overshoot of the beam centre to about half-way into the other side and a smooth turn back to the beam centre (Fig. 4), the nature of the turn signals required to accomplish this is shown in Fig. 5. This is, in fact, what is accomplished by the Sperry Automatic Approach Control. In operation, it means that the human pilot can switch to "Localizer" on the auto approach switch ("Gyropilot," "Localizer" and "Approach" positions) as soon as the localizer needle leaves its stop on either side, at any intersection on the beam.

Fig. 3.



Successful brackets have been made at angles of intersection up to 179 deg, but as this depends on the aircraft staying within the confines of the beam during the resultant 179 deg turn as explained above, angles of intersection greater than 90 deg are not recommended under operation conditions.

From the pilot's point of view, the procedure is to position his aircraft at a range of 10 to 12 miles on the downwind side of the airport at a height of about 1,500ft, following a suitable B/A procedure and using the A.12 Controller with the Automatic Approach Control (A.A.C.) switched to "Gyropilot." The height selected is maintained within close limits by the A.12 altitude control. At this stage the localizer needle will be against the stop to left or right and the Glide Path needle against the upper stop, showing that the aircraft is positioned below the Glide Path to one side or other of the beam. The aircraft is then flown towards the beam on such a course that the angle of intersection is 90 deg or less. The A.A.C. is switched to "Localizer" as soon as the localizer needle leaves its stop, whereupon the turning of the aircraft will be under automatic control and the correct ground track will be established. While this is going on the wheels can be lowered, the power reduced, the airscrew pitch changed, the flaps lowered and an approximate 2½-deg nose-down attitude introduced by the pitch control and taken out by the A.12 altitude control. When the Glide Path needle moves to the centre, the A.A.C. is switched manually to "Approach." The altitude control is automatically switched off and the aircraft assumes the nose-down attitude previously selected, being held in the localizer and Glide Path beams automatically. Any elevator trim which may be necessary is also introduced by the trim tab servo of the A.12 so that, after passing over the three marker beacons (by which time the pilot should be able to see the runway) the Gyropilot "Release" button on the control column is pressed and the landing of a correctly trimmed

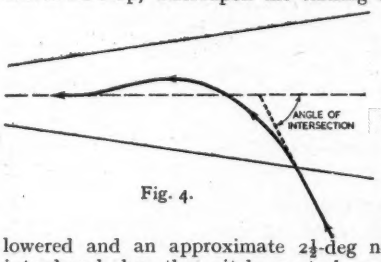


Fig. 4.

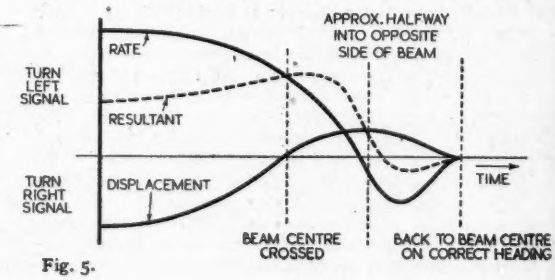


Fig. 5.

TOWARDS HAPPIER LANDINGS

aircraft is effected manually in the usual manner.

If the wind is not directly down the runway, the aircraft heading will change automatically to take up any drift. The drift will introduce a displacement from the beam and, by the combination of "rate" and "displacement" turn-producing signals, the aircraft will be brought back on to the localizer beam on the correct heading to compensate for any cross-wind. In actual practice, a 40-knot wind at 90 deg to the runway has been experienced during the Prestwick trials mentioned above, and the consequent drift was taken up with no difficulty whatever. Bank angle is restricted to about 25 deg with the approach switch in "Localizer" and to about 10 deg in "Approach," while pitch change is restricted to about 5 deg up or down when under automatic glide path control.

Airspeed during descent is controlled manually by the throttles, but there is a Sperry Constant Airspeed Control in production to take over this function from the human pilot. This Airspeed Control E-1 comprises three components: throttle servo; airspeed control amplifier, and airspeed control switch. By operating all throttles automatically as though they were one, the Control will maintain the airspeed existing at the time it is turned on. Any one throttle may be reset manually if desired while the Airspeed Control is on by slipping its friction clutch. By maintaining the same airspeed before and after starting down the glide path, the pilot is sure that every degree change in pitch attitude causes a degree change in the flight path. This is essential for good performance. The Airspeed Control is completely independent of the A.12 gyropilot except that the electric release button on the wheel turns off the Control as well as the gyropilot.

The only trouble so far experienced has been due to bends in the SCS.51 beams and, both at London Airport and at Prestwick, the last dip in the glide path occurs within the last 100ft of the descent. Even so, the aircraft has been left under full automatic control down to within 20ft-30ft of the runway with no difficulty whatever and in complete safety.

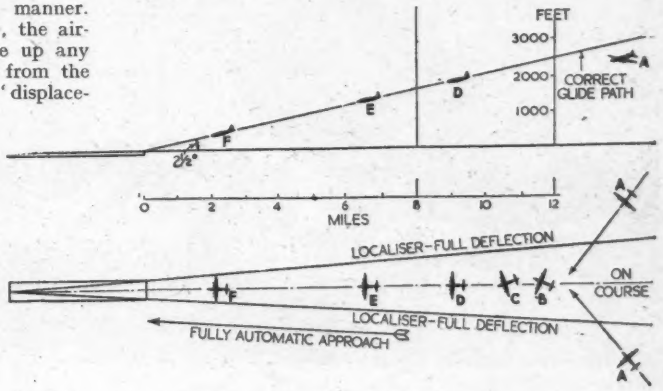


Fig. 6. A: Aircraft turns to intercept localizer beam at about 45 deg. to Q.D.M. ten to twelve miles out. As localizer needle moves from full deflection switch from autopilot to localizer. B and C: Automatic bracketing of beam with allowance made for drift. D: Aircraft approaching on localizer beam. As glide path is intercepted switch to approach. Aircraft is then held to glide path. E and F: Aircraft held to localizer and glide path beams down to a height at which pilot decides to take over.

Acknowledgments are gratefully made to the Ministry of Supply for the use of Liberator KL.632, in which the A.12 Gyropilot and its accessories are installed, and to the manager, flying crew and staff of the B.O.A.C. Development Flight, Hurn, for their wholehearted co-operation along the road towards happier landings.

For The Medway Towns

Club and Charter Service Operating from Rochester

ALTHOUGH Short Bros., Ltd., are shortly due to move from Rochester to Belfast, they will not entirely sever their connection with the city with which they have been identified for the past 33 years: they are to operate a charter service and flying club at the airport there and, indeed, have already commenced operations, the club having 47 members and some 10,000 miles of charter flying has already been flown.

The fleet comprises an Avro XIX, a D.H. Dragonfly, two Proctors and two Tiger Moths. The Avro, the Dragonfly and one Proctor are fitted with radio, and the two latter aircraft also have VHF/BA. and dual control, so that advanced and instrument-rating training can be given. Ordinary dual is £3 5s an hour and solo £3. Private charter is at the standard rates of the Charter Association, whose safety rules are also observed.

The enterprise is under the management of W/C. T. C. Chambers, A.F.C., and the chief pilot is W/C. C. W. Lindsay, A.F.C.—an A.1 category instructor who was in command of a British flying school in America. The other flying staff are Messrs. C. C. H. Dash, A.F.C., I. D. M. Dunlop, and Mr. D. S. Robins is secretary.

Just the right sort of informal party was given to launch the club last Thursday, when the Mayors of Rochester and Gillingham were entertained on the ground and in the air by Mr. D. E. Wiseman (managing director) and other members of Short Bros.' staff. Capt. Lankester Parker, without whom no Rochester function would be complete, was bemoaning the fact that he was earthbound by a gouty foot, but ultimately, and presumably in search of a cure, sampled the local waters in the Seabee amphibian which the firm have purchased from the United States.

"Flight" photograph.

CIVIC AND INDUSTRIAL: (Left to right) The Town Clerk of Rochester; W/C. Chambers (club and charter service manager); the Mayoress of Rochester; W/C. Lindsay (chief pilot); the Mayor of Rochester; the Lady Mayor of Gillingham; Mr. Wiseman (managing director of Short Bros., Ltd.) and the Town Clerk of Gillingham.

CIVIL AVIATION NEWS

Two American Opinions : Marathon News : Bermuda Dispute

CLIPPER AMERICA: The 749 Gold Plate Constellation on arrival at London Airport. A brief study of this aircraft is included in this issue. The airscrew root cuffs to give good airflow into the nacelles are new, as is the airscrew reverse thrust braking.

THE "CHOSEN INSTRUMENT" CASE

EVIDENCE in support of and against the bills which are before the American Senate Inter-State and Foreign Commerce Committee to unite the nation's international airline systems is producing statements and arguments which are interesting to British observers.

Mr. Juan T. Trippe, president of Pan American Airways, told the Committee that "the air travel reservoir was now geared to support foreign airlines instead of American international air transport systems overseas." Two major economic factors, among others, he gave as advantages to foreign airlines. One, he said, was the present system under which they competed against one another instead of presenting a united front to foreign competitors. The other was that foreign airline companies enjoyed lower wage rates than the Americans. In commenting upon lower foreign rate of pay, Mr. Trippe made the observation that labour costs represented about 50 per cent of the total cost of operations, and instanced the B.O.A.C. wage liability as being less than half that of the American companies, and K.L.M. as being even lower. If the United States international air systems were to remain in private ownership, he said, they would have to earn an appropriate return on capital invested in order to maintain credit, whereas competitive Government-owned monopolies had no such obligation.

Mr. Trippe gave the warning that current conditions in travel were not typical. This summer, he stated, passenger accommodation on trans-Atlantic routes was at a premium, and high capacity for American companies on that route was assured for the immediate future, and until the foreign companies, with their unified operations, low labour costs and larger financial resources, could receive modern equipment to meet their requirements; after that, he said, the day of reckoning would come.

On the other hand, Mr. James Landis, chairman of the Civil Aeronautics Board, stated that an analysis of the known facts respecting British and Russian aviation could mean no more than that if America made no progress in the next three to five years, or even longer, it was possible that foreign competitors may take the lead. No one, he said, however, could contend seriously that America would not progress, and in any case the acceptance of a chosen instrument as a panacea was not the solution.

On the subject of British civil aviation developments, Mr. Landis quoted from a despatch from the U.S. Embassy in London. "As for the British producing in the near future any jet transport capable of being used on regular services by an airline, that," he said, "was simply out of the question." Quoting the Minister of Supply he said that there might be something available in 1950, no one knew what it would be however, and to have a transport jet aircraft ready for airlines by then would require every possible good fortune. "Since," he said, "the British have not yet produced a conventional first-class civil aircraft, it seemed fantastic to think that they would be able to do something which no United States manufacturer had ever succeeded in doing; that was, produce a revolutionary type straight off the drawing-board." The optimistic estimate of what and when the British aircraft industry could produce ignored, he considered, the serious industrial position in this country.

There were some, Mr. Landis thought, who regarded the British decision not to buy more American aircraft as recognition of the country's inability to continue the operation of long-distance air routes on a first-class basis. In other words, the basic factor behind the decision was the same as that which caused the country's scaling down of commitments abroad. It was a shock, he said, which the aviation world found hard to take, and while there was a hope that some miracle in the form of a revolutionary transport would save the British airlines, they did not think that would happen.

AVOIDING PASSENGER FATIGUE

SINCE the K.L.M. service to South America was opened at the end of last year, considerable research has been undertaken to determine the reaction of passengers travelling on long-distance flights, and the results have proved to the Dutch airline company that, without doubt, comfort ranks far higher in the minds of air travellers than the desire for greater speed. It was on such an assumption that the original schedules were drawn up and the recent observations have justified that policy of avoiding fatigue to the passengers.

No alteration, therefore, is to be made in the existing schedule to Rio de Janeiro and Montevideo from Amsterdam, which allows two days, with an overnight stop at Lisbon. The flight is made in comfortable stages, the longest being 9½ hours, and landing times at the South American airports have been arranged so that passengers arrive at a convenient hour.

THE MAMBA—MARATHON

NO British civil aircraft has evoked more favourable comment than the Miles Marathon feeder-liner, designed as it was with I.C.A.O. requirements and operator's needs in mind. This was to have been one of the first designs to exploit the qualities of British airscrew-turbines and until recently it was hoped that the Mark II Mamba-powered version might have attained the service-test stage on B.E.A. routes within a year or two. It is now apparent that the Mark II prototype must wait for the best part of two years for its power plants.

Meantime, fifty Mark I Marathons, designed for four Gipsy Queens, will be built for B.E.A. and certain other operating companies. But here again, lack of engines may seriously retard delivery and some alternative power unit may have to be sought.

AIRSHIPS RECOMMENDED

PRESIDENT TRUMAN'S Air Co-ordinating Committee in Washington has reported recently on the advantages of operating airships. The Committee considered that with fares comparable with those on airliners, lighter-than-air craft would find a substantial public demand.

There is at present no commercial airship service, in fact, no rigid airship, as distinct from the blimp used by the U.S. Navy, has been built since 1938.

After reviewing airship crashes, the Committee considered that in the light of present design and operational knowledge there was nothing to suggest that safe airships could not now be operated. They would fly at about a third of the speed of present-day aircraft, that is to say, about 100 m.p.h., three to four times the speed of fast steamships. Travellers, it was thought, would appreciate the relaxation inherent in the more commodious, noiseless and almost vibrationless airships. Passengers would have more space for movement, the use of lounges and dining saloons and would be permitted to carry a larger amount of baggage than in an airliner. Non-stop hops

CIVIL AVIATION NEWS

of 2,500 to 3,500 miles could be made and flights across the North and South Atlantic would be possible all the year round with only occasional weather delays.

Other routes suggested were to South America from both east and west coasts of the United States, California and Honolulu with extensions to Australia.

The stipulation was made that hydrogen would be banned and the lifting gas would be helium. There would also be a definite preference for diesel engines which would provide greater economy and reduce the risk of fire. America has the distinct advantage of having the natural resources for producing helium, which will, of course, influence any desires to operate airships.

I.C.A.O. PERSONALITIES

DR. EDWARD WARNER, who was elected President of the Council of I.C.A.O. at the first meeting of the permanent organization, was a member of the U.S. delegation to the Chicago Conference of 1944. He designed the first wind tunnel at Langley Field in 1919-20, and from 1920 to 1926 was Professor of Aeronautical Engineering at the Massachusetts Institute of Technology. He was Assistant Secretary of the Navy for Aeronautics from 1926 to 1929, and a member of the C.A.B. in 1939. In 1941 Dr. Warner was made vice-chairman of that body.

On the left Dr. Edward Warner, and on the right Dr. Albert Roper.

Dr. Albert Roper, who was elected Secretary General of I.C.A.O., has been in that post since the inception of the provisional organization. He was Secretary General of I.C.A.N. during its twenty-five years of existence, and was Secretary of the Aeronautical Commission of the Peace Conference which drew up the Convention of Paris relating to aerial navigation.

CONGESTION IN AMERICA

SOME interesting figures and comments have come to hand on the operation of American domestic airlines. During 1946, the Government operated control towers at only 117 of the 5,000 airports in the United States. At those 117 airports there were 6,424,720 landings and take-offs. There were six fatal accidents of which four were due to bad weather conditions. During the month of October at Washington airport 341 aircraft were brought in to land using bad weather landing procedure and in the last three months of the year the same airport handled 42,500 operations of all types. Domestic airlines in America throughout the year carried 13,300,000 passengers, nearly twice as many as in the previous year and were flying scheduled services to 175 more cities than in 1945. The airlines completed 95.8 per cent of the scheduled flights.

Senator Owen Brewster, chairman of the Aviation Sub-committee of the Senate Commerce Committee, considered that the existing airport facilities in America were capable of dealing with 400 aircraft flying about 175 m.p.h. whereas there were about 800 flying at 240 to 270 m.p.h. and the result was an air traffic jam. He expects that the passengers wishing to travel by air will increase from the 13,000,000 mark in 1946 to 20,000,000 this year. In 1948 with aircraft travelling at more than 300 m.p.h. and at varying speeds below that, the congestion will be even worse. Improvements, he said, were needed at the airports, and in navigational aid equipment, but the Civil Aeronautics Administration had estimated the cost of installing such equipment at approximately 54,000,000 dollars.

A.R.B. NOTICES

THE Air Registration Board have issued *Notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft Nos. 17 and 18. Notice No.* 17 is in connection with dispensation regarding the issue of certificates of safety by engineers other than those holding licences issued by the Ministry of Civil Aviation. *Notice No.* 18 makes July 31st, 1947, the latest date by which the magneto moulded Vernier couplings on Cirrus Major II and III engines shall be changed to couplings of a different material. C.s of A. of aircraft with these engines installed will be liable to suspension or cancellation after that date unless the change has been made. The Board have made a 6th issue of *Notice No.* 7, which cancels the 5th issue dated November 28th, 1946. The notice is concerned with British Civil Airworthiness Requirements, and particulars of the issued sub-sections are listed.

BERMUDA AIRFIELD DISPUTE

PLANS for the Trans-Canada Air Lines' service through Bermuda and the Caribbean to South America are held up by the U.S. refusal to grant permission for the use of Kindley, the American air base at Bermuda. The base, which was acquired by America during the war by arrangement with the British Government, as part of the American destroyer deal, can now be used only by the U.K. and U.S. for civil use. A permanent agreement is being negotiated but until the terms are decided upon the Americans are unwilling to enter into any temporary arrangement. It is understood that America does not wish to settle the agreement until the use of airfields in Newfoundland has also been discussed. Traffic rights and agreements had been reached with Bermuda, Trinidad and Jamaica, and if the hold-up had not occurred the Canadian service would have already been in operation.

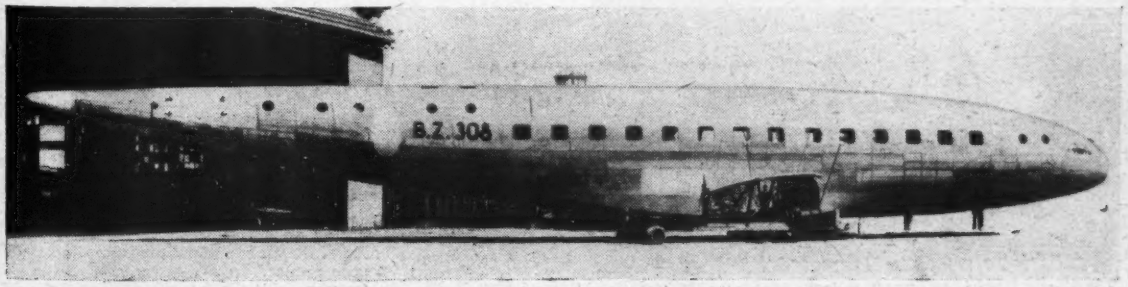
Trans-Canada Air Lines are running ten services a week across the Atlantic, and expect to increase these next month to two services each day. From July 1st faster trans-continental services will be provided by flying across the Great Lakes between Toronto and Winnipeg, reducing travelling time by one hour. Four services are flown daily.

BREVITIES

It is understood that first deliveries of the SAAB Scandia, fitted with Pratt and Whitney engines and a pressurized cabin, will be made by 1949.

* * *

The M.C.A. have decided to give sympathetic consideration to the G.A.P.A.N. appeal for a reduction in the qualifying flying time for the senior commercial pilot's licence from 7,000 hours to 4,000 hours. In exceptional cases applicants with less than 5,000 hours and over 40 years of age will be considered. An analysis of hours flown will be necessary, and due regard will be paid to recent flying experience. Emphasis



ITALIAN DESIGN : The Breda-Zappata 308 outside its hangar. The aircraft has a wing-span of 138ft, an overall length of 110ft, an all-up weight of 46 tons, and an estimated range of 3,106 miles. As mentioned in *Flight*, May 22nd, considerable interest is being shown in the Bz 308, and it has been suggested that Centaurus engines ordered by B.E.A. are for experimental purposes in the Italian aircraft.

CIVIL AVIATION NEWS

in the examination will be laid on a knowledge of modern radio aids and facilities now available.

* * *

B.O.A.C. services to New York are fully booked until the end of July, and to Montreal until the end of October. Nearly all seats on these services are available for non-priority passengers. Transatlantic services to London are running at full capacity.

* * *

The B.E.A. service between Newcastle, Carlisle and Belfast will operate twice daily, excluding Sundays, from July 1st. There will be a minimum capacity of 520 seats a month, and fares for the single journey will be: Newcastle-Carlisle, £1 5s; Carlisle-Belfast, £3; Newcastle-Belfast, £3 19s; Newcastle-Isle of Man, £2 19s 6d.

* * *

The familiar astrodome is to be replaced on the Stratocruiser with a flat-surfaced window. The window is designed to withstand more stress than the dome type, and consists of two layers of laminated safety glass with a filling of clear plastic between. The window is said to provide excellent optical properties in addition to the increased structural qualities.

* * *

Under a recent agreement with United Air Lines, the American domestic company, seventy cities within the U.S. are linked with K.L.M. services from Europe for freight carrying. The company operate a weekly freight service from Amsterdam through Prestwick to New York. United Air Lines flew nearly 1¼ million ton miles of freight during May. This was an increase of 51 per cent over the same month last year.

British West Indian Airways flew 2,000 more passengers in the 1947 January to April period than in the same period last year, the actual number this year being more than 11,000.

* * *

The Scandinavian Airlines System carried 1,256 passengers across the N. Atlantic last month, an increase of 51.7 per cent over April. On June 16th the services were increased from six to seven a week in each direction.

* * *

Sabena have opened new services from Brussels to Milan, Madrid, Lisbon, Deauville, Luxembourg, Dublin, Liége, Le Zoute, and between London and Le Zoute via Ostend. There is also a service from Brussels to New York, and to Cairo.

* * *

K.L.M. opened on June 9th a new service between Amsterdam, Geneva and Rome. Operating three times a week, the addition offers immediate connections with services from London, New York, Rio de Janeiro and Montevideo. Total travelling time from London to Rome is 13 hours.

* * *

In the first quarter of this year the number of miles flown by Australian airlines increased by 46 per cent over the comparative quarter last year, the number of passengers carried increased by 80 per cent, and freight by 120 per cent. The percentage of seats occupied dropped owing to the use of larger aircraft.

* * *

The Australian Civil Aviation Department has issued an exhaustive questionnaire to all airline operating companies, asking for details of revenue, expenditure, profits, assets, equipment, plant, maintenance and operating costs. No guarantee has been given that the information will be confidential. Opinion in Australia suggests that the government is making the enquiry to find the most profitable routes which could be absorbed by T.A.A. as part of the nationalization scheme.

FROM THE CLUBS

CATERING licences, like most others, are difficult things to obtain these days, but the Luton Flying Club has at last been successful in obtaining one. Meals should be available at Luton shortly for private owners and visiting club flyers who "drop in" there. The Rapide which the club purchased recently is being kept busy flying parties of eight here, there and everywhere.

* * *

An official reopening party, an announcement of which will be made shortly, is to be held by the Redhill Flying Club, who have already started flying again following the granting of an airfield licence. The club has four Austers and three Magisters, and during its first week of flying two solos were made from scratch on the Magisters. The club, which is operated by British Air Transport, Ltd., who also operate a charter business by that name, has a bar and catering facilities, and is open throughout the week. Entrance fee is one guinea, annual subscription three guineas, and flying rates are £3 10s an hour dual and £3 solo.

* * *

The latest members of the Weston Aero Club, Ltd., to receive their "A" licences, are Mr. R. E. Lewis and Mr. W. P. Jones. Three other members are now waiting for suitable weather to get in the required three hours solo. The new club premises with bar and restaurant have lately been opened—a "house warming" party was held there on May 31st—and the club is well attended by members and their friends.

* * *

The Ultra-Light Aircraft Association announce that after three and a half months of intermittent discussions with the M.C.A. they held their first meeting with the Air Registration Board on May 29th, when, during a 3-hour session, the Association's suggestions and proposals were discussed in broad detail. It is not possible to give a full report of this meeting at the present time, but we understand that the Association's representatives are confident that agreement will be reached on a scheme under which amateur-built aircraft will once again be allowed to fly.

* * *

At some of the more northern flying clubs it was not until the end of May that the weather became good enough for club flying to be resumed. Members of the Strathtay Aero Club, which operates from Perth airfield, were able to muster only twenty hours' flying during May, and that was largely confined to nine days, during which time a first solo was achieved by M. McLean. The club has until recently been flying two Tiger Moths, and these have now been joined by a new Auster, which is receiving high praise from Strathtay members. Following an Extraordinary General Meeting of the club, the pilot subscription has been reduced from four guineas to three guineas and the associate subscription and entry fees have been raised from one guinea to two guineas each. It is a healthy sign that membership of the club continues to increase.

The Martin Hearn demonstration team photographed recently at Thruxton beside the prototype Slingsby glider designated "Type 20". It is a two-seater, dual control machine, designed for *ab initio* training, and the conversion of pilots from power aircraft to gliders. "Type 20" is now in production at Hooton Park. (L. to R.) G. Hancock, C. Hearn, L. Rimmer and G. Collett.

"Flight" photograph.

The demonstration D.C-4M-1 on the tarmac at London Airport before departing for Canada.

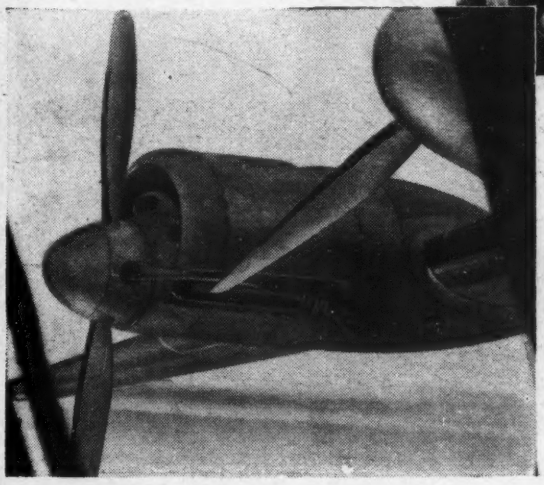
Canadair Four

Rolls-Royce Engined DC-4M Stepped Up in Weight and Accommodation : Impressions in the Air

THE first Canadair Four (DC-4M-4) is now coming through the shops and is expected to be flying in July of this year. Rate of production, it is hoped, will rise very sharply towards the end of 1947 and a figure of fifteen per month is mentioned as a possibility. In the accompanying table are set out the main weights and performances, all of which appear more favourable than the equivalent figures for the DC-4M-1. Seating capacity is increased by four—from 36 to 40—gross weight goes up by 2,000 lb to 80,000 lb and the max. landing weight from 63,500 lb to 68,000 lb. In addition, the cabin will be pressurized on the DC-6 system.

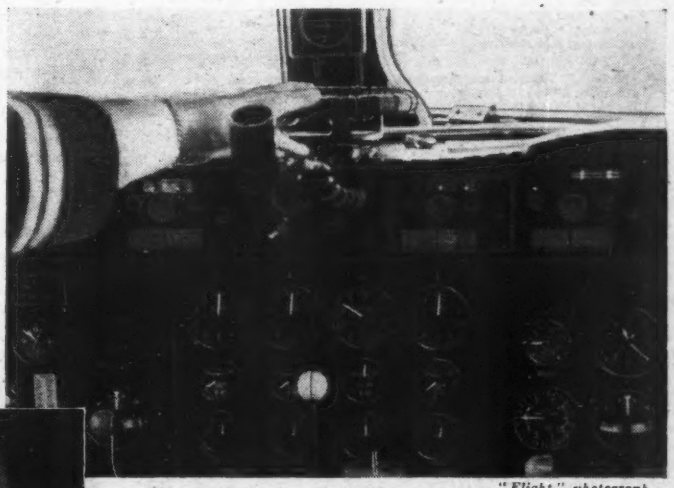
Power plants will still be Rolls-Royce Merlins —the civil Mk 620 variety—which give 1,725 h.p. for take-off at 20 lb boost and a normal maximum output of 1,285 h.p. For maximum cruising, up to 23,500ft, 1,160 h.p. with + 9 lb boost is taken out of each power unit.

It will be remembered that the DC-4M was originally built as a transport aircraft for the Royal Canadian Air Force and six of these have been loaned to Trans-Canada Airlines to run their transatlantic service between Montreal and London. Ten journeys each way per week are made. All six of these aircraft were fitted out by Canadair, Ltd., to T.C.A. specifications.



"Flight" photograph.

NO DECEPTION : The two port Merlins feathered while flying above the cloud at 9,000ft.



"Flight" photograph.

FLYING ON ONE : Engine rev counters show three airscrews feathered and the remaining Merlin turning at 2,850 r.p.m. Altimeter shows 9,350ft and the rate of climb zero. Capt. Lilly's hand is adjusting the rudder trim to counteract the asymmetric thrust.

Recently we had an opportunity of flying in one of the DC-4M-1s while it was being demonstrated by Capt. A. Lilly, Canadair's chief test pilot, who has 6,000 hours airline piloting to his credit in addition to 4,000 hours test flying.

At an all-up weight of 63,000 lb the aircraft left the ground after a run of only 13 seconds and climbed at more

CANADAIR FOUR

than 1,700ft per min. Reaching 8,000ft, one of the Merlins was stopped but the remaining three held the rate of climb at 1,500ft per min. At 9,000ft both port airscrews were feathered and, with the Merlins each running at 2,650 revs, a climb of 200ft per min was still maintained. Finally a third engine was stopped and at that altitude, height was lost at the rate of only 150ft per min. Capt. Lilly said that the DC-4M will hold its height on one Merlin, running at 2,850 r.p.m., at any altitude below 6,000ft.

Demonstrating the viceless stall under landing conditions, the wheels and flaps were lowered and the nose pulled up. A distinct tail buffeting could be felt as the A.S.I. fell to 80/82 m.p.h. At 75 m.p.h. the nose went down sharply but there was no tendency for a wing to drop. It is said that if a pilot is quick with the throttles no more than 20ft need be lost in a stall.

Level flight, at normal cruise power, provides very pleasant travel. Speech between passengers can be made without straining either voice or ears. Hitherto, some criticism has been made of the noise intensity in the cabin of the M-1. A special type of exhaust manifold, designed by Canadair, has now replaced the stubs on the cabin side of each power egg and this has brought the sound level down to that of the DC-3. The exhaust batter on the cabin walls has quite disappeared. Rolls-Royce, Ltd., intend to do further development work on this exhaust manifold.

"Flight" photograph.

HOLD-OFF: The first-pilot's view of the runway as actual contact is made. The black streaks on the cement are caused by aircraft tyres skidding for the first few yards on each landing.

Good piloting, together with the tricycle arrangement and the attitude which the DC4 takes up when the flaps are lowered, makes landing appear to be a very simple operation for a machine of its weight and speed. The end of the runway remains a steady picture in the pilot's windscreen during the whole of the approach and only disappears underneath as the stick is pulled back for the hold-off. Even then the tail-up attitude of the Canadair Four ensures for the pilots a good field of vision, both forwards and downwards.

At the weight at which the 4M was flying—63,000 lb—and cruising at 240 m.p.h., fuel consumption during the flight worked out at 196 Imp. gallons per hour.

CANADAIR FOUR (DC-4M-4)

Operating Weights:	
Max. take-off gross weight	80,000 lbs
Max. landing weight	68,000 lbs
Max. zero fuel weight	63,000 lbs
Operating weight empty	48,115 lbs
Manufacturer's weight empty	45,456 lbs
Useful load	34,544 lbs
Max. fuel load	21,250 lbs
Max. weight capacity payload	14,885 lbs
Max. cargo space capacity	9,548 lbs
Max. cargo volume	682 cu. ft.
Take-off and Landing Distances (at sea level)	
Take-off, at 80,000 lb	1,033 yd.
Landing, at 68,000 lb	933 yd.
Maximum Cruising Speeds:	
At 26,000 ft.	328 m.p.h.
At 23,000 ft.	317 m.p.h.
At 15,000 ft.	286 m.p.h.
At 10,000 ft.	280 m.p.h.

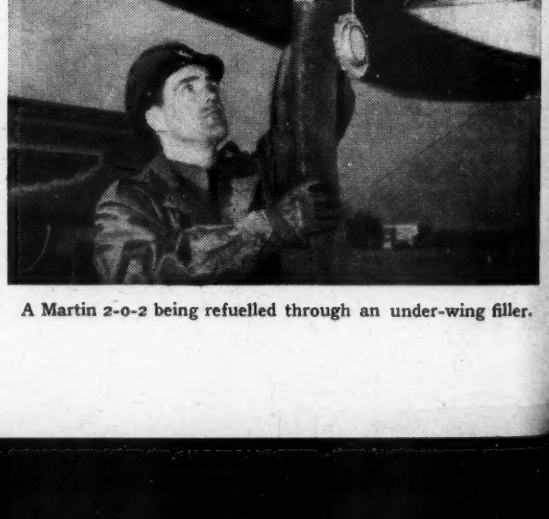
UNDER-WING REFUELLING

A NEW and interesting fuelling technique, especially applicable to aircraft whose parked attitude places the wings at a high level from the ground, has recently been developed in America. The idea is that instead of feeding fuel into the tank from on top of the wing, it should be pumped in from beneath. This departure from the orthodox method of refuelling presents several advantages, the main one being that of speed. An important additional benefit is that it obviates the need for ground crew to clamber over nicely polished wing surfaces, and the whole operation of restocking the tanks can be accomplished by one man standing on the ground. Our picture shows this procedure being carried out on a Martin 2-0-2, the American aircraft which incorporates "underfuelling."

From a paper by Mr. H. O. Olson, excerpts of which were published in a recent issue of the *S.A.E. Journal*, we gather that there are still several problems to be solved before underwing fuelling becomes acceptable to any great extent. The main points in the paper cover the designing of a standard bayonet-type quick-disconnecting fitting, and the structural problems involved in the mounting of such a fitting.

A worrying aspect is the risk that an operator, unable to see how much petrol had been pumped into the tank, might over-fill and consequently burst the tank seams with the accompanying danger of a serious fire. However, a mechanical safety shut-off device has been successfully incorporated, which makes use of a float circuit breaker and shuts off the pump as soon as the fuel reaches its expansion area. Consideration is also being given to a rupture plate located on the top of the wing and designed to burst should the circuit breaking device fail to function.

Despite its apparent advantages, general adoption of this new fuelling method is likely to be slow. Some airline operators would not accept a mechanical shut-off device as completely safe, and the job of conversion of present tank filler necks would become formidable unless aircraft manufacturers were prepared to produce conversion kits for existing aircraft.



A Martin 2-0-2 being refuelled through an under-wing filler.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters

NAMING THE E10/44

Another Suitable Suggestion

WITH reference to the letter from Mr. G. Ellis, printed in the issue of June 5th, from which I gather that no official name has yet been chosen for the Supermarine E10/44, I should like to add my own suggestion: that it be called "Stiletto."

This is again alliterate, and does not trespass upon a name well known and remembered. It might also be considered a tribute to the machine's grace of line and performance, not to mention the comparative quietness in operation of its "jet."

K. E. F. POPE.

BLIND APPROACH PRESENTATION

Graduated and Continuous Performance

FURTHER to my letter of May 22nd, and Major Parkes' reply, I had a shrewd suspicion that graduated and continuous information was what he intended to provide, though it was not, I think, made quite clear in his article. If this can be done, then I do not think that the idea of a "little cinema show," referred to by "CBGR," would be any more of a leg-pull, even at night, than some of the existing systems. I, for one, would wish the promoters of any such scheme all the luck in the world.

There is a proposal to utilize the film technique for a track indicating device, as many readers will probably know, enabling straight track to be flown on so-called "hyperbolic systems."

Radar-painted flare paths, of course, would only be practicable—with primary Radar—for flying boats using buoys with corner reflectors, due to "ground clutter," and secondary Radar would mean a tiny responder for each flare with all the attendant complications.

Also, what about infra-red? Do not let this "pulse madness" carry us too far.

"VERTIGO."

SUPER-GIANT AIRCRAFT

Views of a Pioneer Constructor

IN competition with the U.S.A. we are apparently being forced to build such giant aircraft! The Americans can afford to do so. Can Great Britain? I very much doubt it. Even the very much smaller aircraft we built for Imperial Airways, Ltd., had to be subsidized. The Americans did it by a high charge for airmail. I would not build an aircraft more than fifty tons or a flying boat above sixty-five tons. We could build so many more aircraft and compete with the Americans.

We are borrowing dollars; the puddle is nearly dry. Who is going to pay? Rich and poor alike, by taxes. Are we not starting a snowball on the top of a mountain which will end in an avalanche of taxation? I am afraid so. Early in the history of flying boats I forecast flying boats of 150 tons and over. I have changed my mind, as a wise man should.

What wonderful things small private aircraft companies are doing, as far north as the Shetland Isles!

Despite what was said about me in the House of Lords, I am the inventor of stressed skin metal construction and once held all the vital patents. I had clever aircraft designers of far greater mathematical attainments than myself, but I led them, and I corrected them, when they were making mistakes. If anyone doubts my statements, I put only one first question to them: How did it come about that four horizontal struts tied together all the six Rolls-Royce "Condor" engines in the "Sarrafand"?

When I was 53 years of age I flew from Pembroke Docks to India with 210 Squadron as a guest of the Air Ministry. Flying down the Persian Gulf at 2,000ft, I went out to help the mechanics to swing over by hand an engine which had stopped. We got the engine started, but the draught of the propeller blew me back on the oily surface of the lower plane. I ended up by clinging to the rear horizontal strut. My foresight in design had saved my life. It was *almost* the narrowest escape I have ever had.

H. O. SHORT, F.R.Ae.S.

Hon. Life President, Short Brothers.

CONGO BOUND

Most Favoured Nation Treatment

HAVING read in *Flight* the two "Congo Bound" articles of F/L. Weaver, I feel both slightly amused and severely shaken.

Amused at the kind of first-hand information he gives concerning aviation in the Belgian Congo, and shaken at the idea that other information I have found in your paper, and believed, might be of equal value.

If you are interested in reliable and comprehensive documentation about aviation down here, my Service will be glad to do its best to enlighten you.

One word about F/L. Weaver's ridiculous exhibition at Léopoldville. He got away with it in remembrance of a very kind C.F.I. in Spitalgate (yes, such a man did exist) who once refused to courtmartial me in more or less similar circumstances, on the ground that I was allied personnel.

This, of course, Weaver was not told, but, believe me, he didn't get any more apologies than I got myself on that day!

M. LAGOUGE.

Le Directeur du Service de l'Aeronautique, Léopoldville.

BY PROCTOR TO THE CAPE

Some Details of a Private Owner's Trip

YOUR copy dated May 8th has just arrived and I was interested to read Part II of D. W. Weaver's *Congo Bound*. But I feel some of his comments about airfields on the route might be qualified, at least by my experience when flying my Proctor V G-AIYZ out to South Africa during January-February this year. I should add that I am air touring out to S. Africa and will shortly fly back to the U.K. Although I've been flying a long time I have had very little experience of tropical flying or of piloting small aircraft, and am thereore as "green as you make 'em."

With three of us and baggage in the Proctor, our route was: Hurn — Bordeaux — Lourdes/Le Puy — Nice — Ajaccio — Cagliari — Tunis — Luqa (Malta) (a diversion to see friends) — Castel Benito — Marble Arch — Bennina (Benghasi) — El Adem — Mersa Matruh — Maryut (Alexandria) — Almaza (Cairo) — Luxor — Wadi Haifa — Atbara — Khartoum — Kosti — Malakal — Juba — Torroro (Uganda) — Kisumu — Nairobi (Eastleigh and Civil) — Nanyuki — Nakuru — Njoro — Moshi — Dar Es Salaam — Lindi — Porto Amelia — Lumbo — Quelimane — Beira — Inhambane — Lourenco Marques — Rand Airport, Germiston. I've also tootled about the Union a good deal. The standard Proctor V, fully loaded but without long-range tanks, gave us a safe range of 360 statute miles.

It was a very straightforward flight except for the stretch through France when the snow and weather was terrible and I had to make a forced landing. Lourdes/Le Puy is a nice little airfield though rather small. It has one shed, a 70-octane installation and an excellent pub in Lourdes village.

Cagliari was "closed" but *force majeur* and my old job in the R.A.F. overcame reception difficulties. This was the only place except the Rand where we met a stony front of discouragement to start with. But they did us proud before long.

Marble Arch, visited in a dust storm with Barnard Potter in his Fairchild, plus three commercial aircraft, was manned by five Bedouin who "very" slowly provided 73-octane petrol in jerrycans. Cigarettes are their means of exchange. The runways were crumbling in January and stray barrels driven before the wind careered across the field. Not pleasant.

At Bennina we slept in a Nissen hut, but the grub was good in the N.A.A.F.I. Mersa Matruh is manned, but there are no Customs yet. Maryut is a good airfield though the runways are cracking. There is no hangar, but our reception by officials and Customs was very friendly. How different from Almaza! My landing fee in Egypt was 32 piastres. There was a met. station at Luxor which gave me a good weather forecast.

Wadi Halfa is a compulsory stop, and for aircraft not fitted with W/T. there is a delay of several hours while permission to proceed is obtained from Khartoum. The Railway Hotel is excellent. Atbara and Kosti are satisfactory, and at Juba we were given a most helpful and friendly reception by the R.A.F. It is a hot and unpleasant place and every latitude should be

CORRESPONDENCE

given fellows stationed there. I would add that Shell's service was astonishing throughout and beyond praise.

We were forced to land at Tororo (Uganda) through loss of power owing to plugs getting dirty. It is a two-strip airfield, 1,500-1,350 yd, 4,000ft above sea level. No fuel is available, but there is an excellent hotel and a friendly reception. Shell send a car the 100 miles from Kisumu with sufficient supplies.

I chose the route down the Portuguese East African coast for three reasons: (1) You cannot get lost following a coast line; (2) sea-level take-offs; (3) better weather. I am glad I did, for at that time Central Africa was having particularly bad weather. The airfields are good; there was considerable hospitality and, half a mile out to sea, flying conditions were bump-free all day.

I would recommend any amateur, such as myself, to go by that route, and I have sent details of each airfield to the R.Ae.C., Shell and the Ministry of Civil Aviation.

If my plans continue as I hope I expect to be wandering home in July-August by a similar route. P. S. FOSS.

PRIVATE CEYLON AIRLINE

In the Pre-Beechcraft Days

FURTHER to B. J. Hurren's article in your June 12th edition, in which he makes reference to Neville Stack's "private" airline in Ceylon, I thought a little more information on this might be of interest to many of your readers.

The R.N. communication flight started at the beginning of 1943 with an ancient Swordfish flying twice a week from Katakurunda via Colombo (Race Course) and Puttalam to Coimbatore in Southern India. This flight was later based at Puttalam and very soon ran a daily service from Colombo to Coimbatore and Cochin with a connecting link across Ceylon to China Bay. When the old grass airfield at China Bay was rendered u/s by monsoon rain, this link was flown by a Walrus which put down in Trincomalee harbour.

No radio operators, radio sets or navigators could be carried as all the available pay-load was urgently required. The Swordfish were modified to carry three passengers and often sacks of goods were tied on the wings and such things as motor bicycles, etc., strapped between the undercarriage legs. Such was the "Stringbag" that we had no casualties.

A word of praise is due to the pilots, mostly young New Zealand Sub. Lieuts. from 1st line squadrons who had been stopped from proceeding home on leave, and who cheerfully undertook their new duties flying in all types of weather with no navigational or radio aids.

By December, 1943, this little band of enthusiasts had been running the "airline" for a year with old Swordfish assisted by one Fulmar for V.I.P.s. It was not until this time that a fleet of American Beechcraft and Neville Stack arrived to take over.

No letter on this subject would be complete without remembering a very old and weary R.A.F. Anson "The Lanka Belle" which plodded round Ceylon for several years and was the only alternative Service air transport. Finally we must remember the "erks" who cheerfully, in intense jungle heat or monsoon rain, kept the outfit going. LESLIE GILBERT.

A.T.C. DECLINE

A Sergeant's View of the Present Troubles

THE R.A.F.V.R. and the U.A.S. have been revived; but what of the A.T.C.? The Corps is dwindling away and nothing is done to remedy the decline.

An A.V.-M. once told a group of cadets that the R.A.F. wanted at least 100,000 active boys in the A.T.C. At the present time I doubt if there are 25,000, and this pitifully small number is receiving only about one-third as much instruction as it would have done in 1943. The position is steadily worsening, as recruits are simply just not forthcoming, and at the same time cadets are leaving for the Services.

Most A.T.C. cadets are more than lucky if they get ten minutes' flying a year, and that in a crate as steady as a rock. Besides, cadets get rather tired of getting to a 'drome (no transport) and then being told, after stooging around for a couple of hours, "sorry, no aircraft available." This is what often happens, although arrangements had been made weeks before for the flight and the cadets are losing wages to be there.

Similar things occur with other A.T.C. activities. Units are being promised radio sets, and one squadron received theirs a few months ago. The transmitter turned out to be from a flying bomb (V-1) in pieces and with about 250 per cent spares, no details of the German marking codes, and a wiring diagram of a two-valve set for which the parts could not possibly be used!

I have spoken to many cadets and the following are their main grouses: not enough flying; uniform neither smart nor comfortable; too much bookwork; too many broken promises.

Efforts to remedy the decline of the A.T.C. by the local committees have failed miserably in all parts of England. Nevertheless, I am convinced that if the Air Ministry took the trouble, the Corps could be re-established on a sound footing within three months, and unless this is done the A.T.C. will cease to exist in a very short while.

I would like to point out that the large majority of A.T.C. officers do everything in their power to get the best possible training, equipment, etc., for their cadets, but, unfortunately, they have not a free hand on the most important matters.

Sgt. SEC, A.T.C.

BOOK REVIEWS

Petrol-Engined Model Aircraft (including some notes on Diesels). By C. E. Bowden. Percival Marshall and Co., Ltd. 7s 6d net.

AS G/C. Pelly-Fry remarks in his foreword to this most instructive work, super-charged with the lore born of long experience, there is evidence that the petrol model aircraft has begun to return after its enforced wartime disappearance. No one is better qualified than Lt. Col. Bowden to pronounce on petrol-driven models and his intimate survey of the field is as readable as his "tips" are practical.

Aircraft Engines (Volume II), by A. W. Judge. 36s. Chapman & Hall.

VOLUME ONE of *Aircraft Engines* deals chiefly with theory and experiment, and Volume Two, first published in 1941, with detailed description of engines and their components and systems. A second edition of this last-named work of reference has now been printed, and it contains a long new chapter on "Recent Developments and Future Trends," intended to bring the book up-to-date to the end of 1946.

The introduction of the subject of gas turbines for the first time by no more than a cross-heading and the discussion and dismissal of most of the existing types of turbine power units all in a dozen pages of a 500-page book, seems, to say the least of it, disproportionate. The author, however, devotes some pages to the possible layouts of huge piston engines giving up to 10,000 h.p. and may, therefore, have more belief in the future of such units than we have.

Water injection was suggested and tried on automobiles in this country at least twenty years ago. In view of the reluctance of British manufacturers until the last year or so to adopt water/methanol injection on high-powered aircraft engines, some credit might have been given to the American designers who have done so much development work on liquid injection during the last ten years. The author quotes several examples of German engines equipped with what he calls this "innovation."

FORTHCOMING EVENTS.

June 28th.—South Coast Flying Club: Tea patrol, Shoreham Airport.
June 28th and 29th.—Luton Flying Club: Summer meeting, display and competitions.
June 28th to 30th.—Aero Club of Le Puy en Velay: Rallye Lafayette.
June 29th.—Auster Flying Club: Annual air rally. Rearsby airfield, Leicester.
July 2nd to 23rd.—Air League of British Empire: Blackpool (Squires Gate) Flying displays with R.A.F. support on 9th, 16th and 23rd.
July 3rd to 13th.—Soaring Contest for Swedish National Championship, Orebro, Sweden.
July 4th to 20th.—Brussels International Aero Show.
July 6th.—Gloucester Flying Club: At Home and flying display, Staverton airfield.
July 12th to 14th.—Deauville International Air Rally.
July 13th.—Royal Aero Club of Belgium: International flying meeting at Liege.
July 19th to 21st.—International Air Rally at Knocke Le Zoute.
July 20th.—Prague: International air display.
July 20th.—Northern Heights Model Flying Club: Gala day at Langley airfield, Bucks.
July 26th and 27th.—United Services Flying Club: Air display and air rally. Elstree airfield, Herts.
July 30th to August 9th.—Aero Club of Switzerland: International gliding contest. Samaden in the Engadine.
Aug. 1st.—Start of Belgian "Aerial Fortnight," Le Zoute.
Aug. 2nd and 3rd.—Aero Club de Versailles: St. Cyr air rally.

SERVICE AVIATION

OCCUPATIONAL FORMATION : Mosquito VI fighter bombers of 140 Wing, B.A.F.O., practice formation flying north of the Ruhr. An account of the work of 140 Wing appeared in *Flight* of June 12th.

S. of S. in Germany

THE Secretary of State for Air, the Rt. Honourable Philip Noel-Baker, M.P., arrived at Northolt last Friday after a short tour of R.A.F. and W.A.A.F. units in Germany. He flew from Prague to Fassburg on June 17th, accompanied by his Personal Assistant Mr. J. S. Orme, his Parliamentary Private Secretary, Mr. Kenneth Younger, M.P., and his Personal Air Secretary Wing Commander G. L. Sinclair. At Fassburg he was met by the A.O.C., 84 Group, A.V-M. P. Maitland and by the Station Commander, G/C Williams. As a former Olympic runner, the S. of S. showed great interest in the station sports.

At Celle he dined with the A.O.C. (84 Group) and Air Commandant F. Hanbury, Director of W.A.A.F., and visited the Celle Malcolm Club. The following day, accompanied by Air Commandant Hanbury and A.V-M. Maitland he flew to R.A.F. Lubeck, where he was met by the A.O.C.-in-C. of the British Air Forces of Occupation, Air Marshal Sir Philip Wigglesworth. He visited airmen and their families in the married quarters and toured the station.

The next call was at 123 Wing, Wunstorf, where Mr. Noel-Baker inspected aircraft and talked to maintenance crews. He later left by air to spend the night at the A.O.C.-in-C.'s residence, after dining with the Marshal of the R.A.F. Sir Sholto Douglas.

On Thursday, after touring the R.A.F. station at Hamburg and the Hamburg Equipment Depot, Mr. Noel-Baker attended a cocktail party given for him by the officers of Air Headquarters, B.A.F.O.

Jets Support Infantry

JET fighters supported a battalion of infantry in a demonstration of Army support staged on Salisbury Plain recently under the direction of Major-General Sir Arthur Dowler, Inspector of Infantry.

Royal Air Force and Naval Aviation News and Announcements

Appointment

THE Air Ministry announces the appointment of A. V-M. Charles Ronald Steele, C.B., D.F.C., as Air Officer Commanding Air Headquarters, Malta.

A. V-M. Steele has been Senior Air Staff Officer, British Air Forces of Occupation (Germany) since July, 1945, and formerly commanded No. 85 Group, 2nd Tactical Air Force, from the formation of 2nd T.A.F. in 1944 until it was merged into B.A.F.O. at the end of the war. Previously he was on Air Staff operations duties at the headquarters of Fighter Command and from September, 1942, until March, 1943, he was Senior Air Staff Officer at No. 9 Fighter Group headquarters, which appointment he assumed after two years as Senior Air Staff Officer at the headquarters of the Southern Rhodesian Air Force. From early in 1940 until the fall of France he was at the headquarters of the British Air Forces in France.

Born in Ecclesall Bierlow, near Sheffield, in November, 1897, he was educated at Oundle and Sandhurst and was commissioned in the Yorkshire Regiment in January, 1916. He transferred to the R.F.C. in the same year and obtained a permanent commission in the R.A.F. in 1919.

Transport in April

IN something like 8,100,000 miles flying during April by passenger and troop-carrying aircraft of the R.A.F. there were no accidents involving death or injury.

U.S.A.A.F. General Here

LIEUTENANT-GENERAL GEORGE E. STRATEMEYER, Commanding General, Air Defence Command, United States Army Air Forces, arrived by air from America at Northolt on June 17th. He was welcomed by A. V-M. T. M. Williams, Commandant of the R.A.F. Staff College, and the R.A.F. mounted a guard of honour. During his ten-day visit he has been discussing subjects of mutual interest with members of the Air Staff and the Commanders-in-Chief of Fighter and Reserve Commands.

R.A.F. Yacht Club— W.A.A.F. Admitted

OFFICERS and ex-officers of the W.A.A.F. may now become members of the R.A.F. Yacht Club at Calshot Castle, R.A.F. Station, Calshot, Hants. A number of yachts are available to members and the club claims one

SERVICE AVIATION

of the best starting lines for sailing races in the district.

Winter Sports President

AIR VICE-MARSHAL R. M. FOSTER, Assistant Chief of Air Staff (Policy), has accepted the presidency of the recently formed R.A.F. Winter Sports Association.

R.O.C. Recruiting

SINCE the Royal Observer Corps began to re-form last November nearly 11,056 men and women have been enrolled. The figures for May were 409 men and 48 women. Membership is still open to men and women over 16 and below 45, for Centre service, and below 50 for Post service.

The Britannia Shield

COMPETING teams of all nations taking part in the contest for the Britannia Shield during Battle-of-Britain week will arrive in this country on Monday, September 15th, and will be officially welcomed on behalf of the Air Council on the following day. The competition is open to members of the Armed Forces of nations who took part in the Battle of Britain, or whose Armed Forces were assembled on British soil between 1940 and 1945.

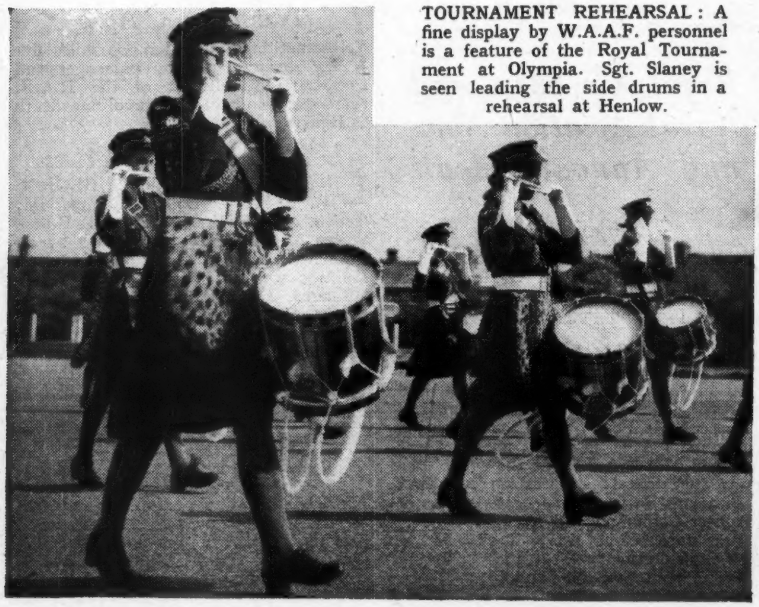
Fencing competitions will be held at the London Fencing Club's headquarters on September 17th and 18th; the cross-country run on September 18th will be over a five-mile course, starting from R.A.F. Station Halton, and the shooting will be at Bisley on several days during the week. Eltham Baths will be used for the swimming events on September 17th, and the finals of the boxing and the presentation of the Shield will take place at the Empire Pool, Wembley, on September 19th. On September 21st competitors will attend the Battle of Britain service.

SOME CONSOLATION : Some of the cadets who were disappointed in not being selected to travel with the Royal Family to South Africa were taken to Norway in the aircraft carrier H.M.S. *Vengeance*. Admiral Sir John Cunningham, First Sea Lord, is seen with cadets of the Royal Marines and A.T.C. and Sea Cadets.

E.A.N.S. Missions

AFTER spending a fortnight with B.A.F.O. units in Germany, flying in the Halifax *Sirius*, a liaison mission from the Empire Air Navigation School, Shawbury, visited the French School of Navigation at Caseaux on June 16th. A similar visit was made last December, and in August, 1946, a mission from the French school visited Shawbury, where several of its students had received training.

On June 18th another E.A.N.S. mission, flying in the Lincoln II *Aries II*, left for the Middle East. Twelve members of the crew are making the trip, which is planned to last for three weeks.



TOURNAMENT REHEARSAL : A fine display by W.A.A.F. personnel is a feature of the Royal Tournament at Olympia. Sgt. Slaney is seen leading the side drums in a rehearsal at Henlow.

Good Sport in the Far East

THE A.C.F.E. team challenge cup was won by a team from Seletar, Malaya, with an aggregate of 61 points, in the R.A.F. Air Command Athletics championship lately held in perfect weather on the R.A.F. sports ground, Singapore Island. Among Senior Officers present were: A.V-M. Sir George Pirie, Commander-in-Chief, Far East; A.V-M. F. F. Inglis, Senior Air Staff Officer, A.C.F.E.; A.V-M. J. D. Breakey, A.O.C., Malaya; A.V-M. A. C. Sanderson, A.O.A., A.C.F.E.; and Air Commodores A. R. Wardle, S. N. Webster and G. S. Shaw, A.O.C.s of Ceylon, Hong Kong and Burma respectively.

The six teams which contested the thirteen events represented Malaya "A" (Changi), Malaya "B" (Seletar), Malaya "C" (Tengah), and Ceylon, Burma and Hong Kong. Close runners-up to Malaya "B" team were Malaya "A," with an aggregate score of 55 points, who were the winners of the runners' team challenge cup.

Prizes were presented by Mrs. Inglis, wife of A.V-M. Inglis, and the results were:—

Three miles final, F/L. J. P. Haile, Burma, 16 min 27 sec; 880 yards, F/L. J. P. Haile, Burma, 2 min 9⅘ sec; 120 yards hurdles, F/O. A. F. Dorward, Hong Kong, 18⅘ sec; Throwing the discus, W/C. R. I. M. Bowen, D.F.C., Malaya "A," 95ft 11in; 100 yards, Sgt. D. H. Sutton, Malaya "B," 10⅕ sec; Putting, Sgt. D. H. Sutton, Malaya "B," 34ft 4in; 220 yards, Cpl. S. R. Sewell, Hong Kong, 24 sec; Long jump, F/O. H. J. E. Howe, Malaya "D," 20ft 6½in; One mile, F/L. J. P. Haile, Burma, 4 min 57 sec; 440 yards, Sgt. L. G. Wilson, Malaya "A," 54⅘ sec; Javelin, F/O. G. Gough, Burma, 134ft 6in; 4×100 yard relay, Malaya "B" team (Sgt. F. Pendlebury, F/O. W. C. Kendall, F/L. H. J. E. Howe and Sgt. D. H. Sutton), 47⅕ sec; High jump, F/L. C. F. Rechens, Ceylon, 5ft 6in; One mile medley relay race, Malaya "A" team (S/L. P. H. Waterkeyn, D.F.C., Cpl. Carrigan, A/C. M. J Davies, Sgt. J. Morris), 3 min 56 sec.

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